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Dutch Elm disease in the United States, 1930 to 1938.—*Plant Dis. Reptr*, xxiii, 6, p. 92, 2 maps, 1939. [Mimeographed.]

The maps accompanying this brief note show the areas in which elms infected by *Ceratostomella ulmi* have been found since the detection of the Dutch disease in the United States in 1930 (*a*) in the country as a whole, and (*b*) in the area surrounding New York Harbour [*R.A.M.*, xviii, p. 282].

MARCHAL (É.) & MAYNÉ (R.). **État actuel de l'étude de la maladie de l'Orme.** [Present state of the study of the Elm disease.]—*Bull. Soc. for. Belg.*, xlvi, 5–6, pp. 193–202, 1939.

In this paper (a report of the Commission Spéciale du Conseil Supérieur des Forêts de Belgique, dated 29th April, 1938) the authors, after briefly reviewing the geographical distribution and etiology of Dutch elm disease (*Ceratostomella ulmi*) [see preceding abstract] and expressing the view that the disease may possibly be transmitted by *Pteleobius* [*Hylesinus*] *vittatus* and *P.* [*H.*] *kraatzi*, discuss the question of control. The disease is too widespread in Belgium for eradication to be practicable, and the cost of fungicidal treatment by root absorption or injections appears to be prohibitive. The best method of control would appear to be the use of resistant varieties. In Belgium, *Ulmus foliacea fastigiata* (*dampierii*) has so far remained unaffected, while *U. stricta* (*cornubiensis*) is also recommended. Propagation should be effected by layering or by grafting on a very resistant variety.

BURNS (M. M.) & TAYLOR (N. H.). **A survey of Tung groves in New Zealand.**—*Bull. N.Z. Dep. sci. industr. Res.* 66, 61 pp., 16 figs., 1 graph, 1 map, 1939.

This bulletin contains notes on two diseases of tung oil trees (*Aleurites fordii*) in New Zealand, viz., 'puffy bark' and root rot.

'Puffy bark' is the name applied to a condition in which the tissues external to the wood of the main branches or trunk become swollen and pulpy and finally split away from the wood. In the incipient stage the epidermal layers are cracked, dried, and shrunken, chiefly as a result of exposure to strong, cold winds and growth on poorly drained soils. This phase, if not corrected by appropriate stimulatory measures, is followed by the swelling (to several times their normal thickness) and vertical splitting of the tissues between the wood and the bark.

Consequent on this abnormal growth of the phloem and cortex, the transport of nutrients to the upper portion of the tree is arrested and die-back ensues. The 'puffing-up' and splitting of the cortical layers usually proceeds downwards, and may kill the tree to within a few inches of ground-level. Trees thus affected often produce small secondary or 'feather-leg' shoots on the trunk below the diseased site. The best temporary remedy for this phase of the trouble is the removal of the branch at a distance of about 6 in. below the lowest affected point. 'Puffy bark' is generally most severe on the submature and mature podsols, mature granular clays, and hillside meadow soils of the Awarua complex. Of special interest during the recent survey of the tung groves was the occurrence of severe cases of the disease on the low-lying sections of the small fertile terrace on the banks of the Parapara Stream. Wherever the water-table was near the surface all the trees were affected and many had died, but where it was deeper only some of the largest had suffered.

A close association was observed between 'puffy bark' of the aerial system and root rots (taken collectively), the most severe losses (up to nearly 100 per cent.) from which were recorded on areas of heavy, poorly drained soils manured with blood-and-bone fertilizer round the roots of transplanted stocks.

Forest research in India, 1937–38. Part II. Provincial reports.—151 pp., 1939.

The following items of phytopathological interest occur on pp. 96–98 of this report. Observations by K. D. Bagchee indicated that unsoundness of sal (*Shorea robusta*) in the Singhbhum forests of Saranda, Bihar, is most prevalent (up to 75 per cent.) on white shale soils with an abundant cover of sabai grass (*Pollinidium angustifolium*) and least in evidence on red lateritic or iron ore slopes. The two fungi associated with unsoundness are *Fomes tricolor* [*R.A.M.*, xvii, p. 278] and *Trametes incerta*, both causing heart rot and the latter probably being responsible for the crooked appearance and knotty protrusions characteristic of affected trees. Mortality frequently occurs in mature stands of vigorous trees on dead red loam soils and is chiefly due to *Polyporus shoreae* [loc. cit.], which gains ingress through the roots and travels slowly up the stem.

Baxter (D. V.) & Wadsworth (F. H.). **Forests and fungus succession in the Lower Yukon Valley.**—*Bull. Sch. For. Mich.* 9, 52 pp., 9 pl., 3 diags., 1939.

The alluvial-flat forests of the lower Yukon meander belt, undisturbed by fire or axe, afford possibilities for the study of the natural time factor of disease incidence from the pioneer to the climax stages. *Melampsora bigelowii*, for instance, is chiefly injurious to willow (*Salix alaxensis*, *S. pulchra*, and *S. arbusculoides*) [*R.A.M.*, viii, p. 90] seedlings up to two years old, being of little importance in older stands, which are liable to infection by *Valsa salicina*, *V. sordida* [*Cytospora chrysosperma*: ibid., x, p. 418; xvii, p. 567], *F. igniarius* and its var. *nigricans* [*F. igniarius*: ibid., xvi, p. 715], *Poria ferruginosa*, *Trametes suaveolens*

[ibid., xi, p. 811], *Favolus canadensis*, *Pholiota adiposa* [ibid., xvi, p. 716], *Cytidia flocculenta*, and *Steccherinum ochraceum*. Willows are dominant for 45 to 50 years, after which they are gradually eliminated by fungous cankers, heart rot, and other adverse factors, to be replaced by spruce (*Picea glauca* and *P. mariana*) and an admixture of birch (*Betula alaskana* and *B. kenaica*), this succession (from the time of bar formation to the climax forest) occupying some 175 years. At this stage *Fomes pini* [ibid., xviii, p. 559] and *F. igniarius nigricans* are prevalent and very destructive on spruce and birch, respectively, with the addition of rusts and their alternate hosts not found in other communities, e.g., *Melampsoropsis* [*Chrysomyxa*] *ledicola* (*Peridermium decolorans*) on spruce needles [ibid., xv, p. 259] and *Ledum groenlandicum* and *L. decumbens*, *C. pyrolae* on *Pyrola* spp. [ibid., xvii, p. 618; xviii, p. 59], *C. cassandrae* on *Chamaedaphne*, *Peridermium coloradense* forming brooms on *Picea mariana* [ibid., xv, p. 794], and *Pucciniastrum myrtilli* [ibid., xv, p. 510] on *Vaccinium*.

The bearing of the ecological conditions of the forests under observation on the presence of some fungi and the absence of others, notably *Polyporus schweinitzii*, is fully discussed.

A list of other fungi recorded in the region is furnished.

HEARMAN (J.). **Minor elements and the Pine.**—*Aust. For.*, iii, pp. 24–27, 1938. [Abs. in *For. Abstr.*, i, 1, p. 22, 1939.]

A marked improvement in the condition of *Pinus radiata* affected by a rosette-forming disorder in Western Australia was secured by treatment with zinc chloride, while a certain stimulus to growth was also given by manganese and ferrous sulphates, cobalt and nickel chlorides, sodium molybdenate, and boracic acid, accompanied in some cases, however, by injurious effects, especially from the nickel, cobalt, and copper salts. Protracted observations on the local stands indicate that the rosette disturbance is not due to actual soil deficiency but to inability of the trees to assimilate the elements under the prevailing conditions.

WATERMAN (ALMA M.). **The disease of Pines caused by Sphaeropsis ellisii.**—*Plant Dis. Reptr*, xxiii, 6, pp. 93–95, 1939. [Mimeographed.]

The pine disease caused by *Sphaeropsis ellisii* (*Diplodia pinea*) has been found to be widely distributed in the eastern and middle-western sections of the United States [*R.A.M.*, xvii, p. 573], the most susceptible species being the Austrian pine (*Pinus nigra*) [var. *austriaca*], followed (in the order named) by *P. sylvestris*, *P. resinosa*, *P. montana*, *P. ponderosa*, *P. strobus*, and *P. virginiana*. The fungus has also been observed in one instance on *Pseudotsuga taxifolia* [ibid., xvi, p. 75] and *Picea pungens* growing in proximity to heavily infected Austrian pines, on older specimens of which the progress of the disease is relatively slow, infection gradually working upwards from the lower branches. Cross-inoculation tests with the Austrian pine strain of *D. pinea* gave positive results on *P. sylvestris*, *P. resinosa* and *P. ponderosa*. Effective control has been obtained in ornamental plantings by three to four applications of 4–4–50 Bordeaux with a soap spreader.

KLEBAHN (H.). **Untersuchungen über Cronartium gentianeum v. Thümen.** [Studies on *Cronartium gentianeum* v. Thümen.]—*Ber. dtsch. bot. Ges.*, lvii, 2, pp. 92–98, 1939.

The positive results of cross-inoculation experiments (in collaboration with Adolfine Buschmann) conclusively demonstrated the genetic connexion between a *Peridermium* on Scots pine (*Pinus sylvestris*) and *Cronartium gentianeum* on *Gentiana asclepiadea* in the Graz district of the Ostmark (formerly Austria) [*R.A.M.*, xviii, p. 73]. On the other hand, the relationship between *C. gentianeum* and *C. asclepiadeum* [loc. cit.] on *Vincetoxicum officinale* is not clear. The evidence at present available points to their identity, the physiologic races on *G. asclepiadea* and *V. officinale* being specialized on their own hosts, but further investigations are necessary definitely to confirm this hypothesis.

BARRETT (J.). **Timber salvage from Douglas Fir trees infected with conk rot (Trametes pini).**—*J. For.*, xxxvii, 7, pp. 577–578, 1939.

The writer examined a Douglas fir [*Pseudotsuga taxifolia*] stand in the north-western United States to determine the profitability or otherwise of timber salvage from trees infected by conk rot (*Trametes* [*Fomes*] *pini*) [*R.A.M.*, xv, p. 694]. Of the 1,057,376 ft. cut during the course of the inspection, 386,112 (38 per cent.) were diseased. The calculations made on the basis of a 25 per cent. total loss in the conversion of net scale on the ground to commercial log scale in the pond denote that heavily infected trees, i.e., those on which conks appear within 20 to 30 ft. from the ground and continue up to the top, should not be cut. Good footage, on the other hand, may be expected from slightly infected trees.

SOKOLOFF (D. V.). **The toxic action of hydrogen sulfide on certain molds and tree pathogenic fungi.**—*Mitt. forsttech. Akad. Kirov* (*U.S.S.R.*), li, pp. 70–77, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 13, p. 5028, 1939.]

Solutions of hydrogen sulphide at concentrations of 5 to 14 per cent., with periods of exposure from one to six hours, proved lethal to *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Poria vaillantii* [*R.A.M.*, xviii, p. 362], and *Fusarium avenaceum* in experiments in the U.S.S.R. The viability of pine seedlings did not suffer from short exposures to 3 to 4 per cent. solutions. Penetration to a depth of 1·5 cm. results from six hours' contact of the wood with 10 per cent. hydrogen sulphide.

FREYFELD (E. E.). Влияние влажности на произрастание в древесине дереворазрушающих грибов. [The effect of humidity on the growth of wood-destroying fungi in timber.]—*Sovetsk. Bot.*, *1939*, 1, pp. 99–103, 4 figs., 1939.

In experiments with *Poria vaporaria* [*R.A.M.*, xviii, p. 493] dry blocks of infected timber containing viable mycelium were suspended in wide-necked bottles with different degrees of relative humidity. At relative humidities of 100, 96, 94·8, and 94·2 per cent. saturation, the mycelium appeared on the outside of the blocks after 3, 4 to 5, 5 to 6, and 6 to 7 days, respectively, and the water contents of the blocks at the time of the appearance of the mycelium were 30 to 32, 27·8 to 29, 26·9 to 27·8, and 26 to 27 per cent., respectively. At 93·6 per cent.

relative humidity the water content of the blocks reached 25 per cent., but no mycelial growth was observed. When blocks of healthy dry timber were suspended in bottles some distance above blocks with well-developed mycelium or pure cultures of *P. vaporaria* the hyphae invariably grew towards the healthy timber in whatever direction it was placed, and spread over it, the water content of the healthy block having by then risen to between 30 and 31 per cent. In a relative humidity of 96 per cent. the mycelium spread from the diseased to healthy timber when the water content of the latter had reached 28 per cent., but attempts to induce infection on timber with a lower water content proved unsuccessful. It is concluded from these results that the minimum water content for the growth of the mycelium of *P. vaporaria* in infected timber is 26 per cent., and that healthy timber can be infected by *P. vaporaria* when its water content in 96 per cent. relative humidity is not lower than 28 per cent.

Mourashkinsky (K. E.). Окрашивание иодом при распознавании трутовиков. [Iodine staining as a means of differentiation of tinder fungi.]—*Bull. Soc. Nat. Moscou*, Sect. biol., N.S., xlvii, 4, pp. 261–265, 1938. [French summary. Received July, 1939.]

Both *Ungulina lapponica* [*Polyporus lapponicus*], and the later-described *U. ursina* [*P. ursinus*] showed the same colour reaction when stained with iodine and are considered to be identical. Their hyphal tramae became light or dark blue and the hyphal contents yellow, the most intense colouring being shown by the characteristic cystidia, for which the name amyloid cystidia is proposed. Negative reactions were obtained with *Leptoporus* [*Polyporus*] *erubescens* and the majority of other tinder fungi tested, with the exception of the group included in *Poria calcea*, most of which showed the light or dark blue colouring at the base of fruiting bodies or in isolated hyphae (or parts of them) as well as in the hyphal contents, older fruiting bodies showing the colour reaction more readily than immature ones. In *Ganoderma lucidum* and *Ungulina fomentaria* [*Fomes fomentarius*] the hyphae of the cuticle developed a light blue colouring. It is believed that colour reactions, and among them those obtained by iodine, should prove very useful in the differentiation of species of tinder fungi.

Gibbs (J. G.). **Factors influencing the control of club-root (Plasmodiophora brassicae).**—*N.Z. J. Sci. Tech.*, xx A, 6, pp. 409–412, 1 fig., 1 diag., 1939.

In the absence of a host, some spores of *Plasmodiophora brassicae* survived in the soil for a period of five years in the Palmerston North district of New Zealand [*R.A.M.*, xiv, p. 732], and in the sixth caused slight infection of Majestic swedes. No club root developed, however, in cabbages planted in the seventh year after the removal of the original diseased crop (rape [*Brassica napus* var. *oleifera*]). The longevity of the spores in the soil did not appear to be influenced by the use of infected ground for grazing, rotational cropping, haying, or treatment with carbonate of lime or sulphur (1 to 5 tons and 3 cwt. per acre, respectively).

GREENHILL (A. W.). **The effect of boron on the growth and quality of Sugar Beet.**—*Ann. appl. Biol.*, xxvi, 2, pp. 392–396, 1939.

In this paper, read at the Annual Meeting of the Association of Applied Biologists held in London in 1939, the author sums up the present knowledge on the heart rot disease of sugar beet.

STIRRUP (H. H.). **Sugar Beet diseases.**—*Ann. appl. Biol.*, xxvi, 2, pp. 402–404, 1939.

In this paper, read at the Annual Meeting of the Association of Applied Biologists held in London in 1939, it is stated that the term black leg [*R.A.M.*, viii, p. 629] covers several troubles of sugar beet seedlings, namely true black leg, insect injury, injury associated with soil acidity, and wind damage. True black leg, caused by *Phoma betae* and species of *Pythium* and *Rhizoctonia*, is favoured by poor tilth in the seed-bed, low soil temperature, lack of moisture, and cold winds. Seed treatment with a mercury disinfectant has been found to confer a certain degree of control, besides increasing the incidence of seedling emergence, but when conditions are favourable for growth little or no benefit accrues. Injury due to soil acidity can be either confined to the radicle and young lateral leaves, in which case the root system becomes tough and string-like, this type being provisionally named stringy root, or it affects the hypocotyl, which remains thin and tough with a brown and scurfy surface, this type being provisionally named stringy hypocotyl. Various fungi, chiefly *Fusarium* spp., isolated from roots and hypocotyls of such seedlings, are believed to be secondary invaders. Acid soil injury and wind damage, which latter may affect hypocotyls, cotyledons, or true leaves, are believed to be two of the primary causes of strangle disease [ibid., xv, p. 764], which originates in the seedling stage as some form of internal injury to the hypocotyl near soil level, forming a constriction in this region and causing the plants to break off at the strangled region. Most of the other diseases of sugar beet described in this paper have been noticed from previous papers of this author [ibid., xiv, p. 548; xviii, p. 226]. The various root rots mentioned include the black, shiny rot caused by *Phoma betae* on a root not affected with heart rot; wet rot caused by *Phytophthora megasperma* occurring only on heavy, wet soils; and internal zoned rot, a disease considered to be physiological in nature, characterized by well-defined necrotic zones in the internal tissues of the root. [A popular account of the seedling diseases of beet is given by the author in *Brit. Sug. Beet. Rev.*, xiii, 1, pp. 9–10, 3 figs., 1939.]

POZHAR (Z. A.). Влияние температуры на продолжительность инкубационного периода церкоспороза Сахарной Свеклы. [The effect of temperature on the length of the incubation period of *Cercospora beticola* on Sugar Beet.]—*Научн. Зап. по Сахарн. Прom.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xv, 3–4, pp. 198–203, 1938. [Received July, 1939.]

The results of field inoculation experiments carried out in 1936 and 1937 by the Pan-Soviet Scientific Research Institute of Sugar Industry showed that the incubation period of *Cercospora beticola* on beet

[*R.A.M.*, xviii, p. 365] varied from 7 to 57 days (usually 10 to 13) according to the temperature. The shortest incubation period occurred at an average temperature of 19° C., the maximum temperature during this period being 25°, and the minimum 10°. The incubation period was lengthened by the rise or fall of the maximum and minimum temperature to above 25° or below 15°. It is suggested that the dates of spraying should be adjusted to coincide with the ends of the incubation periods calculated from temperature records which should be taken after the appearance of the first leaf spots. A table is presented in which the length of incubation periods is tentatively calculated from varying average, maximum, and minimum daily temperatures. Three or four spray applications a year are recommended.

Salunskaya (Mme N. I.). Химические меры борьбы с церкоспорозом Сахарной Свеклы. [Chemical methods of control of *Cercospora beticola* on Sugar Beet.]—*Научн. Зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*]. *Kieff.* [Grey Ser.], xv, 3–4, pp. 204–218, 4 figs., 1938. [Received July, 1939.]

The information presented in this paper has already been noticed from another source [*R.A.M.*, xvii, p. 367].

Storey (I. F.). **Experiments and observations on a virus disease of winter Spinach (Spinacia oleracea).**—*Ann. appl. Biol.*, xxvi, 2, pp. 298–308, 1 pl., 1939.

A virus disease of spinach observed in 1936 at Slough, and found to be common in the Thames valley is described. The first symptom in the field is a yellowing of the younger leaves, which later spreads to the outer leaves, the plant becoming stunted, the younger leaves distorted, and the outer leaves limp till they lie on the ground. The older tissue disintegrates, the rotting spreads to the inner leaves and finally to the root, and the plant dies. In the field death occurs 50 to 64 days after the appearance of the first symptoms; in artificially infected plants the first symptoms appeared about 20 to 30 days after inoculation, and death occurred within from 80 to 96 days. The virus was successfully inoculated by means of sap from diseased plants into spinach, cucumber, tobacco, and *Nicotiana glutinosa*, but no infection occurred on tomato. On the basis of inoculation studies the virus under investigation is considered to be identical with cucumber virus 1, and the disease is thought probably to be the same as that recorded from America by McClintock and Smith (*J. agric. Res.*, xiv, p. 1, 1918).

Field counts on three farms in 1937–8 showed the losses due to the disease to be 19, 13, and 40 to 50 per cent. of the total stands, respectively. Early sowing (4th August) was followed by a greater incidence of disease and a higher degree of aphis infestation than later sowing (18th August and 1st September). Seeds from healthy and artificially infected plants showed 85 and 10 per cent. germination, respectively, and seeds from healthy and naturally diseased plants 90 and 15 per cent., respectively. No evidence of seed transmission has as yet been obtained. Vegetable marrows and summer spinach were also found to be infected by cucumber virus 1 and are probably the chief sources of infection in

the autumn. Their removal from the vicinity of spinach plantings is therefore advocated for the control of the disease, as well as sowing as late as the second half of September. The disease is easily transmissible by mechanical means, and care should be taken by workers not to spread infection on their hands.

CHAMBERLAIN (E. E.). **Pea-streak (Pisum virus 3).**—*N.Z. J. Sci. Tech.*, XX A, 6, pp. 365–381, 7 figs., 1939.

Since 1932 a streak disease of peas, apparently distinct from the disorders described under the same name from other countries, has been observed in the Palmerston North district of New Zealand, where it causes purple or purplish-brown markings on the leaves and pods and a dark discoloration of the stems, followed by cessation of growth and ultimately by the death of the plants. In the field the disease, for which the name of *Pisum* virus 3 is proposed, occurs only on garden peas; in experimental variety trials it has been responsible for heavy losses, especially in Day's Early Surprise, Hundredfold, Senator, Admiral Beatty, Gradus, Great Crop, and Laxton's Progress, a high degree of resistance being shown by Benefactor, Pride of the Market, Little Marvel, Wm. Massey, Autocrat, and the field peas Unica and White Ivory. Pea streak is readily transmissible by juice inoculations but not by aphids. Nineteen out of 52 species of Leguminosae and Cucurbitaceae tested for their reaction to the virus were found to be susceptible, namely, blue and yellow lupins (*Lupinus angustifolius* and *L. luteus*), *L. mutabilis*, beans (*Phaseolus vulgaris*), soy-beans, sweet peas, hairy vetch (*Vicia villosa*), *Galega officinalis*, red, white, alsike, cluster, nodding, and strawberry clovers (*Trifolium pratense*, *T. repens*, *T. hybridum*, *T. glomeratum*, *T. cernuum*, and *T. fragiferum*), hare's-foot trefoil (*T. arvense*), *Lotus hispidus*, cucumbers, vegetable marrows, and rock melons (*Cucumis melo* var. *cantalupensis*). The symptoms of the disease on the experimental hosts are briefly described.

The longevity of *Pisum* virus 3 was found to extend over a period of 41 days *in vitro*; its dilution end point is 1 in 1,000,000, its thermal death point 78° to 80°, and it is capable of traversing a 'fine' grade Mandler filter.

Control measures should be based on the use of resistant varieties, roguing and destruction of infected plants, and care to avoid spread through handling.

CHAMBERLAIN (E. E.). **Bean-mosaic. (Phaseolus virus 1 of Smith, 1937.)**—*N.Z. J. Sci. Tech.*, XX A, 6, pp. 381–388, 4 figs., 1939.

An account is given of bean mosaic (*Phaseolus* virus 1) [*R.A.M.*, xviii, p. 430], which has been observed in the Plant Research Station Area, Palmerston North, New Zealand, since 1933, affecting both *P. vulgaris* and *P. multiflorus*. The disease is of economic importance only on the popular Canadian Wonder variety, but Case-knife (runner) is also susceptible. Under local conditions infection is transmitted through the seed of both these varieties. Control measures involving the production of mosaic-free lines and breeding of resistant varieties are recommended.

Yu (T. F.). **Mild-mosaic virus of Broad Bean.**—*Phytopathology*, xxix, 5, pp. 448–455, 1 fig., 1939.

From April to June, 1934, broad beans (*Vicia faba*) in different parts of Kiangsu and Chekiang Provinces, China, were affected by a hitherto apparently undescribed virus disease, characterized by a mild, diffuse type of mottling and slight elongation of the leaves, without vein-banding, crinkling or rolling, curvature of the midrib, necrotic spotting, stunting, or distortion. The disorder is less prevalent than common mosaic [*R.A.M.*, xviii, p. 224].

In transmission experiments with the bean aphid (*Aphis rumicis*) the mild mosaic virus was pathogenic to its own host, lucerne, red, white, and white sweet clovers (*Trifolium pratense*, *T. repens*, and *Melilotus alba*), spring and winter vetches (*V. sativa* and *V. villosa*), *V. tetrasperma*, sweet peas, and field peas. It was conveyed by artificial juice inoculations, using carborundum as an abrasive, from broad bean to the three clovers, three vetches, and sweet peas. In lucerne, clovers, and peas the symptoms (which did not include foliar elongation) appear 14 to 27 days after colonization by bean aphids, 8 to 18 days being the usual period for the vetches; rolling and rugosity of the lower leaflets are features of infection in the latter.

The mild mosaic virus was found to resist ageing *in vitro* for three hours at 22° to 24° C., its inactivation temperature and tolerance of dilution being 55° to 60° and 1 in 1,500, respectively.

Hülsenberg (H.). **Zur Frage der Spargelrostbekämpfung mit kupferhaltigen Spritzbrühen.** [On the question of Asparagus rust control with copper-containing sprays.]—*Nachr. SchädlBekämpf., Leverkusen*, xiv, 2, pp. 65–72, 4 figs., 1939. [English, French, and Spanish summaries on pp. 93, 97, 100.]

Discussing the conflicting results hitherto obtained in Germany in the control of asparagus rust (*Puccinia asparagi*) with copper-containing sprays [*R.A.M.*, xviii, p. 292], the writer briefly summarizes the data from experiments in the Giessen district with Bayer neu plus a sticker or wetter, the most effective of which was preparation 2002 (I. G. Farben), followed by X and 2040, while Y was unsatisfactory. The percentages of plants in the (*a*) 0 to 2·5 and (*b*) 3 to 3·5 and (*c*) 4 to 5 classes (0 being free from infection and 5 very severely diseased) were as follows: (*a*) sprayed with Bayer neu plus 2002, X, 2040, and Y, 27·68, 23·74, 18·91, and 8·10, respectively, untreated 1·33; (*b*) 40·85, 26·83, 28·60, 25·47, and 5·18; and (*c*) 31·45, 46·22, 52·65, 59·48, and 92·86, respectively. It is concluded that effective control may be secured by the treatment of young plantings a fortnight before the expected appearance of the aecidia, with two subsequent applications; by treatment ten days after thinning-out and one or two further sprays at three-weekly intervals; and by three treatments for three-year-old plantings.

Ainsworth (G. C.) & Ogilvie (L.). **Lettuce mosaic.**—*Ann. appl. Biol.*, xxvi, 2, pp. 279–297, 2 pl., 1939.

This is an expanded account of investigations of which progress reports have been previously noted [*R.A.M.*, xvii, p. 6, 585]. Attention is drawn to the differences in varietal reaction of cabbage lettuces

(*Lactuca sativa* var. *capitata*) to mosaic which have been observed in the field and confirmed by inoculation experiments in the glasshouse. The symptoms [which are tabulated for 24 varieties] ranged from the severely necrotic type in Whitsuntide to mild mottling in Trocadero but there appeared to be little difference in susceptibility between different varieties. Cos lettuce (*L. sativa* var. *romana*), on the other hand, though equally susceptible, showed little varietal variation in symptoms. New hosts were found in groundsel (*Senecio vulgaris*), *Sonchus asper*, sweet pea, and pea. The virus was transmitted through about 6 per cent. of the seeds secured from infected plants and *Myzus persicae* proved an efficient vector under controlled conditions, but this insect is considered of minor importance in the field, where other aphids are implicated.

Lettuce mosaic is stated to be most severe on winter lettuce and a minor disease of lettuce grown under glass, the prevalence of the disease being connected with conditions which favour aphid development.

The virus was inactivated between 55° and 60° C. It aged rapidly in expressed sap and could not be detected in crude sap after 48 hours *in vitro* but inactivation was delayed in the presence of sodium sulphite. The virus, which withstood a dilution of 1 in 50, could not be filtered. For control of the disease the use of clean seed, planting on hilly and open ground unfavourable for aphid infestation, fairly late sowing of winter lettuce (to avoid aphid infestation), and eradication of weeds are recommended. The use of insecticides is advocated for the glasshouse but thought to be of doubtful value out of doors.

Drechsler (C.). **Several species of Pythium causing blossom-end rot of Watermelons.**—*Phytopathology*, xxix, 5, pp. 391–422, 14 figs., 1939.

Substantial losses have been found to result during wet seasons in the watermelon crop of certain regions of the Middle Atlantic States from infection by one or other of the nine species of *Pythium* known to parasitize this host. The fungi usually gain entrance into uninjured fruit through the flower scar and manifest their advance either by water-soaking or a soft, dark, chocolate- to bluish-brown discoloration of the blossom-end tissues, the latter feature being characteristic of *Pythium acanthicum* [*R.A.M.*, xv, p. 109], *P. periplocum* [ibid., xvii, p. 522], and *P. helicoides* [ibid., x, p. 211], full descriptions of which are given to supplement the previous diagnoses.

P. acanthicum, the predominant agent of the disease, produces on Lima bean decoction agar a lustrous, radiating submerged mycelium giving rise on the same medium or watermelon tissue to biciliate zoospores. Maize meal decoction agar provides a more suitable substratum for the study of the sexual apparatus of the fungus, the oogonial and oospore diameters of which ranged from 13·1 to 30·1 and 12·1 to 27·2 μ, respectively (200 of each). The oospores germinate freely on maturity without a resting period and retain their viability for three years.

P. periplocum, isolated from sand pear (*Pyrus serotina*) as well as from watermelon, is characterized on artificial media by an extremely intricate vegetative and reproductive mechanism, the lobate, elongated

antheridia frequently surrounding the echinulate oogonia in a manner reminiscent of the Saprolegniaceae, *Aphanomyces* and *Plectospira*. The oogonial and oospore diameters were found to range from 15·1 to 32·1 and 13·1 to 27·1 μ, respectively.

In essential features of morphology and development the asexual reproductive stage of *P. helicoides* approximates closely to the zoosporangial phase of *P. proliferum* [ibid., vii, p. 253], but conspicuous departures from this familiar type are apparent in the sexual mechanism of the former. The elongated, cylindrical antheridia become virtually fused, from the basal septum to the rounded apex, with the oogonial wall along an arc often equivalent to more than a quarter of the oogonial circumference, while a highly characteristic relationship of the filaments supporting the sex organs is consistently present in a helicoid involvement of an oogonial by an antheridial hyphal element, at least one such spiral arrangement being associated with each unit of sexual apparatus. The internal organization of the oospores of *P. helicoides* is also peculiar, the oily reserve material, instead of being concentrated in a single, large, central globule, being divided into half-a-dozen to a score of smaller ones, while two to four refringent bodies, in place of one, may be embedded in the granular material.

Inoculations on watermelons with the comparatively rare species *P. anandrum*, originally isolated from a rhubarb crown [ibid., x, p. 211], resulted in a fairly rapid decay, manifested externally by dark-brown discoloration. In pure culture on maize meal agar it develops a gracefully branching mycelial habit similar to that of *P. de Baryanum*, *P. irregulare*, or *P. mamillatum*. The average oogonial and oospore diameters are 23·1 to 33·1 and 19·1 to 28·7 μ, respectively. Asexual reproduction occurs sparingly in *P. anandrum*, the solitary, terminal, prolate ellipsoidal to ovoid, papillate sporangia of which resemble those of *Phytophthora citrophthora* and *P. colocasiae*, while the relative large, biciliate zoospores are typical of *Pythium*.

Schultz (H.) & Röder (K.). **Freilandbeobachtungen über die Anfälligkeit van Gurken (Cucumis sativus. L.) gegen Krätze, Blattbräune und Mehltau.** [Field observations on the susceptibility of Cucumbers (*Cucumis sativus* L.) to scab, leaf browning, and mildew.] *Gartenbauwiss.*, xiii, 2, pp. 169–183, 5 figs., 3 graphs, 1939.

Delikatess was the only cucumber variety showing a high degree of resistance to scab (*Cladosporium cucumerinum*) [*R.A.M.*, xviii, p. 508] in three years' (1935 to 1937) field trials at the Experimental and Research Institute for Horticulture on the outskirts of Berlin. The average incidence of infection on this variety was 1·8 (taking 1 as equivalent to entire freedom from disease and 5 as heavily attacked). Among the most susceptible varieties of the 23 enumerated were the German and Russian Trauben (2·7 and 3, respectively). Similar reactions were observed in respect of *Erysiphe cichoraceaarum* [ibid., xviii, p. 465] in 1935 and 1936, when the average values of Delikatess, German and Russian Trauben, Hindenburg, a medium-long, full-bearing Quedlinburg type, and Riesen Schälgurken (the three last-named moderately resistant to scab) were 2·6, 4·1, 4, 4·3, 4, and 4, respectively. There were no significant differences between the test varieties in their

susceptibility to leaf browning (*Sporodesmium mucosum* var. *pluriseptatum*) [ibid., x, p. 501] during the three years under review. The incidence of *E. cichoraceurum* was favoured by the dry conditions prevailing in 1935, whereas the wet season of 1936 was more conducive to the spread of *C. cucumerinum*.

ZYCHA (H.). **Ertragskontrolle bei Champignon-Kulturen.** [Yield control in Mushroom cultures.]—*Gartenbauwiss.*, xiii, 2, pp. 204–211, 1939.

This is an explanatory survey of the environmental and cultural conditions requisite for obtaining high mushroom [*Psalliota* spp.] yields in Germany [*R.A.M.*, xviii, p. 571], where diseases and pests are stated to reduce the crop by 10 to 15 per cent.

BOURIQUET (G.). **Une grave maladie de l'Arachide à Madagascar. La 'rosette'.** [A serious disease of Groundnut in Madagascar. 'Rosette'.]—*Rev. agric. Réunion*, N.S., xliv, pp. 1–7, 1939.

In the vicinity of Lake Itasy, Madagascar, there are extensive areas in which the yield of groundnuts, owing to the presence of rosette [*R.A.M.*, x, p. 639; xvii, p. 725], amounts to only 200 kg. per hect., as against a normal yield for this locality of 1,400 kg. per hect. The disease is transmitted by *Aphis laburni*, which is present in large numbers.

BRANAS (J.). **Études effectuées sur le court-noué en France et en Allemagne et conclusions qu'elles permettent.** [Studies on court-noué in France and Germany and the conclusions they permit.]—*Progr. agric. vitic.*, cxi, 12, pp. 1–4; 14, pp. 5–8; 15, pp. 9–12; 16, pp. 13–16; 17, pp. 17–20; 18, pp. 21–24; 21, pp. 25–28, 7 figs., 1939. [All these are separately paged insets.]

After critically discussing the views put forward by different workers from time to time as to the nature and cause of court-noué of the vine [*R.A.M.*, xviii, p. 294], the author again expresses the opinion that the disease is due to one or more filterable viruses [ibid., xviii, p. 87] transmitted mainly by *Phylloxera* [*vastatrix* f. *radicicola*].

Observations made by the author in Germany lead him to doubt whether 'rollerkrankheit' [ibid., xviii, p. 294] is due to a different virus from that causing court-noué. The former condition occurs at Montpellier on white and red vines on which rougeau does not develop, but which show flavescence [loc. cit.]. Possibly, flavescence or pseudo-flavescence may be a hitherto unrecognized symptom of court-noué. In France, vines affected by court-noué have not been observed to show rougeau, and the two conditions do not appear to be related. There is, however, no longer any possibility of doubt as to the apparent identity of 'reisigkrankheit' [ibid., xviii, p. 371] and court-noué as found in France. The prevalence of the disease in the region of the Ahr [ibid., xviii, p. 294] is very marked, and its mode of development in this locality is not incompatible with the view that spread is due to *Phylloxera*. The methods of control adopted by the local growers are critically discussed, and a French summary is given of the official German regulations for securing healthy vines for reproduction. The paper concludes with recommendations for controlling the disease in

France by assisting growers to recognize the symptoms, preventing the sale of diseased vines and parts for multiplication, and developing healthy vines from seed, where necessary.

Pirovano (A.). **Mitteilungen über europäische Reben, die sich als resistent gegenüber Phylloxera und teilweise resistent gegenüber Peronospora erwiesen haben.** [Notes on European Vines that have given proof of resistance to *Phylloxera* and partial resistance to *Peronospora*.]—*Wein u. Rebe*, xxi, 5, pp. 144–153, 4 figs., 1939. [Italian and French summaries.]

Details are given of the author's hybridization experiments for the development of resistance in vines to *Phylloxera* [*vastatrix*] and *Peronospora* [*Plasmopara viticola*: *R.A.M.*, xviii, pp. 371, 435] at the Grottarossa Fruit-Breeding Institute, Tiber valley, a treeless region of strongly fluctuating temperatures affording ideal conditions for the growth of the fungus. Apart from certain selections among the descendants of crosses between the mildew-resistant Sciamblese and Grecco bianco with susceptible varieties, resistance has also arisen spontaneously in certain individuals resulting from hybridization between two susceptible varieties, e.g., Maddalana reale and Bicane. In some cases the character for resistance was confined to the foliage and in others to the fruits.

Lipetzkaya (Mme A. D.). К биологии зимних спор **Plasmopara viticola.** [On the biology of winter spores of *Plasmopara viticola*.]—*Pl. Prot., Leningr., 1939*, 18, pp. 162–163, 1939.

Under conditions in the Anapa district of the U.S.S.R. *Plasmopara viticola* [*R.A.M.*, xviii, p. 435] was found to overwinter on fallen vine leaves in the form of oospores which caused the first infection in spring. Oospores perish when they remain on the plant, but survive under or on the soil surface, those from under the soil surface germinating more rapidly than those from the surface. In February the oospores require on the average 12·5 days to form conidia, in March 7·3, in April and May 5·6 to 6, but in June they need a longer moist period and often fail to germinate altogether. The optimal temperature for germination was 20° to 25°, but conidia were formed even at 7°. Oospores germinated in water drops and also in soil at 30 to 40 per cent. saturation. It is suggested that short alternating periods of wet and dry weather may accelerate germination. For the control of the disease it is recommended to cut away the green shoots and aerial roots growing at the soil surface, to tie up the shoots in order to prevent contact with the soil, and to finish all deep ploughing before the blossoms open.

Beaumont (A.) & Staniland (L. N.). **Fifteenth Annual Report of the Department of Plant Pathology, Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1938.**—39 pp., 1939.

In this report [cf. *R.A.M.*, xvii, p. 583] it is stated that narcissus growers commonly add a fungicide to the hot water bath used to kill eelworms in the bulbs, in order to prevent subsequent fungal decay (mainly due to *Fusarium* spp., especially *F. bulbigenum* [ibid., xv, p. 224], and *Trichoderma viride* [ibid., xiv, p. 366]). Experimental

evidence showed that formalin (1 qt. in 100 gals.) caused no injury to bulbs of a very large number of narcissus varieties when applied over a wide range of dates, while iodine (1 in 8,000) also caused no injury to bulbs, and was even more effective against eelworms. Methyl mercury nitrate and methyl mercury chloride (1 part mercury in 10,000 of water) caused no apparent injury in most cases, but in a few instances prevented the growth of the bulb.

The following are among the records of plant diseases observed during the period under review. Purple sprouting broccoli was affected by leaf spot due to *Gloeosporium* [*Cylindrosporium*] *concentricum* [ibid., xv, p. 474]. The most serious strawberry disease was mildew [*Sphaerotheca humuli*: see below, p. 693], which appeared on the berries before they were picked, and in some districts ruined the crop. During May, *Zinnia* seedlings in north Devon were badly affected by small dark spots on the leaves bearing beaked spores of a species of *Alternaria* [ibid,. xvii, p. 96], probably identical with *Macrosporium caudatum* [ibid., ii, p. 488; vii, p. 787]. Lilac was attacked by leaf blotch (*Heterosporium syringae*) ibid., xvi, p. 751], barberry (*Mahonia aquifolium*) by rust (*Puccinia mirabilissima*) [*Cumminsiella sanguinea*: ibid., xvi, pp. 257, 342], and violet by crown rot (*Sclerotium delphinii*) [ibid., xviii, p. 183].

Wormald (H.). **Notes on plant diseases in 1938.**—*Rep. E. Malling Res. Sta., 1938*, pp. 167–172, 1939.

These notes on plant diseases studied at East Malling in 1938 [*R.A.M.*, xvii, p. 688] contain the following items of interest. In December, papery bark cankers were noted round pruning cuts on cordon Cox's Orange Pippin apple trees. No parasite was associated with the condition, which appears to have been due to pruning during a rainy period in September, an unsuitable time.

Sclerotinia fructigena was observed in its *Monilia* stage on a medlar fruit at West Malling, apparently for the first time on this host in England. Strawberries were more widely affected by mildew (*Sphaerotheca humuli*) [ibid., xviii, p. 604] than is usual. The leaves were infected and curled, and the flowers and pedicels were attacked, infection being present on the stamens and pistils. In addition, the flower petals were small and highly coloured.

A four-acre field of Yellow Globe mangolds was attacked by violet root rot (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*: ibid., xvii, pp. 368, 796]. Infection in nearly one half of the field reached 50 to 70 per cent., and a few isolated infections were found in the remainder. *Polygonum aviculare*, *P. persicaria*, *Mentha arvensis*, and *Chenopodium album* growing in the same field were also affected.

Victoria plum trees on Purple Egg and Myrobolan B stems at East Malling have not shown any bacterial cankers (*Pseudomonas mors-prunorum*) [see below, p. 689], but those on Pershore (Yellow Egg) have been as severely affected as those on Victoria stems. Morello cherry trees in two plots showed a bacterial leaf spot due to an organism apparently identical with *P. mors-prunorum*.

Hop nettlehead disease [ibid., xvi, p. 836] was very serious in some gardens, a large number of affected plants being grubbed in Kent and the West Midlands.

Lepik (E.). **Estonia : plant diseases new to the country.**—*Int. Bull. Pl. Prot.*, xiii, 5, pp. 105–106, 1939.

Of the nine records of plant diseases newly recorded in Estonia, six have already been noticed in this *Review*, the others being *Botrytis paeoniae* and *B. tulipae* on peonies and tulips, respectively [*R.A.M.*, xvii, pp. 96, 112] and *Ceratophorum setosum* on lupins [ibid., xviii, p. 460].

Seth (L. N.). **India : new diseases recorded in Burma during the year 1938.**—*Int. Bull. Pl. Prot.*, xiii, 6, p. 132, 1939.

During 1938 the following diseases were observed for the first time in Burma: *Cystopus candidus* on cabbage, a species of *Pestalozzia* causing leaf spot of *Aleurites montana*, and a species of *Phytophthora* responsible for root rot of *Achras sapota*.

Park (M.). **Report on the work of the Division of Plant Pathology.**—*Adm. Rep. Dir. Agric., Ceylon, 1937*, pp. D42–D48, 1939.

In this report it is stated that root disease of *Hevea* rubber [*Fomes lignosus*, *F. noxius*, and *Poria hypobrunnea*: *R.A.M.*, xvii, pp. 202, 293] is becoming prevalent in the young replanted areas and on some estates control is proving difficult. Evidence indicated that *Polyporus zonalis* [ibid., xv, p. 471; xvii, p. 88] is parasitic on young rubber and on the bushy green manure plants used as indicators.

Chlorosis of *Hevea* rubber in a nursery on an old lime site was associated with alkaline soil, and was corrected by a dressing of flowers of sulphur. Bird's eye spot (*Helminthosporium heveae*) [ibid., xvii, p. 63], troublesome in some nurseries, was controlled by spraying with a standard copper fungicide.

Other diseases occurring included *Melanconium fructicolum* on pomegranate fruits [ibid., xii, p. 77], *Phytophthora palmivora* on papaw fruits and stems [ibid., xvi, p. 559], and an apparently physiological disease of *Garcinia mangostana* in which the fruits exuded resinous matter and showed partial internal necrosis. Among the diseases recorded for the first time in Ceylon were collar disease of *Achras sapota* due to *Septobasidium* sp., leaf disease of yams (*Alocasia* sp.) (*P. colocasiae*) [ibid., xvii, pp. 587, 731], collar and root disease of *Cicer arietinum* (*Corticium*), root disease (*Poria hypolaterita*) of sweet orange, downy mildew of *Luffa acutangula* (*Pseudoperonospora cubensis*), and *Alternaria solani* on potato.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 1, 5, pp. 248–251, 3 figs., 1939.

In these notes it is stated that the New South Wales Department of Agriculture has decided to express the dilution of lime-sulphur mixtures recommended for spraying purposes as the percentage of polysulphide sulphur present by volume, and has abandoned the use of Baumé readings in this connexion. A table is given showing how much water must be added to stock solutions of lime-sulphur containing given percentages of polysulphide sulphur to make a spray containing any required percentage of this constituent.

The Eureka wheat variety is stated to be highly resistant to stem

rust [*Puccinia graminis*], while Ford and Gluford are resistant, and Bordan, Canimbla, Apollo, Bencubbin, Geeralying moderately resistant, the last three being highly resistant to flag smut [*Urocystis tritici*]. Oat varieties resistant to stem rust are Burke, Lampton, and White Tartarian.

Twelfth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1938.—96 pp., 1938. [Received March, 1939.]

Among the many items of interest in this report [cf. *R.A.M.*, xvii, p. 443] the following may be mentioned. A roughening and cracking of the calyx end of Beurré Bosc pears responded to boron treatment, but pear 'crinkle' (a condition apparently resembling internal cork of apples) was unaffected by boron applications.

Further experiments on the reduction of the root system of young wheat plants infected with flag smut [*Urocystis tritici*: ibid., xvi, p. 664; xviii, p. 373] gave statistically significant results, showing that reduction is almost the same in susceptible and resistant varieties.

Field investigations demonstrated that the pathogenicity to wheat of *Ophiobolus graminis* [ibid., xviii, p. 385] and the amount of seedling blight resulting from artificial inoculation conspicuously increased with depth of seeding.

During the last three seasons data obtained have shown that four virus diseases of potatoes are important in Australia. The chief is mild mosaic or crinkle due to a combination of viruses X+A, the symptoms of which are so varied on different varieties that they have been regarded as distinct diseases. The next in importance is leaf roll. This generally attacks varieties showing resistance to mild mosaic. The third is rugose mosaic, due to viruses X+Y; the symptoms are more severe than those of mild mosaic, but the disease occurs much less often than mild mosaic on the potato varieties commonly grown in Australia. Spindle tuber is also present. Most of the common potato varieties are almost everywhere infected with virus X, the symptoms produced under field conditions being slight or imperceptible.

Diplodia pinea [see above, p. 643] was associated with extensive die-back of *Pinus* spp. near Canberra. Inoculation experiments demonstrated that the fungus readily established itself in terminal growths, but in trees healthy in other respects it did not, as a rule, progress far from the point of inoculation.

Investigations on timber decay treatments showed that in South Australia all the *P. radiata* poles impregnated with creosote [ibid., xv, p. 332] were sound, whereas over half the untreated poles had been destroyed by decay or termites in about two years. In Victoria, poles impregnated with creosote oil were still in good condition, as were others de-sapped and seasoned and then treated by the oxyacetylene process, though all the other treatments had permitted decay. The value of brush treatment with creosote oil and puddling was demonstrated, particularly with poles set green. The condition known as 'heart' in *Eucalyptus regnans* was fairly constantly associated with *Gonytrichum caesium* in fresh material collected from young trees.

When citrus fruits were passed over a commercial sizer more wastage

due to moulds (*Penicillium digitatum* and *P. italicum*) resulted than when the fruits were sized by hand [cf. ibid., xvii, p. 741]. Data showed that storage spot and other low temperature disorders of Washington Navel oranges cannot always be controlled by immediate storage at 45° F. [ibid., xvii, p. 741], but sweating and ethylene treatments gave promising results in the subsequent control of these troubles. Oranges are much less susceptible to storage spot when they have reached the phase of constant respiration.

Storage studies with Jonathan apples showed that the less mature fruits pass through a period of maximum liability to scald [ibid., xviii, p. 443] and minimum liability to Jonathan spot [ibid., xviii, p. 236] when they have passed the climacteric and are approaching the period of constant respiration. Preliminary holding at 65° resulted in greater liability to scald than preliminary holding at lower temperatures. Atmospheres containing 5 per cent. of carbon dioxide and 10 to 16 per cent. of oxygen increased storage life, mainly by controlling Jonathan spot. Higher concentrations of carbon dioxide and lower concentrations of oxygen were injurious.

Plant pathology.—*Rep. Hawaii agric. Exp. Sta., 1938*, pp. 34–40, 1939.

In this report [cf. *R.A.M.*, xvii, p. 731] it is stated that a papaw disease new to Hawaii with symptoms resembling those of yellow crinkle [ibid., xvii, pp. 259, 376] appeared on the island of Oahu in 1937 [see below, p. 693].

The tomato ring spot disease previously recorded [ibid., xvii, p. 732] was transmitted mechanically by the carborundum method to tomato, potato, and *Emilia sonchifolia* from tomato and *E. sonchifolia* and by grafting from tomato to tomato and potato. The incubation period in the tomato was 10 to 16 days, depending on vigour of growth; the more vigorous the growth after inoculation, the more rapidly the symptoms appeared. The virus quickly lost its infectivity in extracted juice, and after one week was recovered from diseased plants only with difficulty. It was not seed-transmitted. On *Emilia* the symptoms are identical with those of pineapple yellow spot [ibid., xviii, p. 465].

The *Pythium* species causing soft rot of taro [*Colocasia esculenta*: ibid., xvii, p. 731] effects entry through the root, particularly in the region of root hair development. Under aerobic conditions the fungus is not a virulent pathogen, but it causes serious losses to plants growing in an unfavourable environment. It grows readily on all common synthetic media, producing abundant aerial mycelium. Chlamydospores occasionally developed in old cultures on oatmeal and potato dextrose agars. Sporangia generally formed in 48 to 60 hours at 28° to 30° C. when aerial mycelium from two- to three-day-old cultures on oatmeal agar or Mehrlich's malt medium were placed in water. The sporangia, which measured 16 to 41·6 by 12·8 to 33·6 (mean 28·8 by 22·4) μ, were borne terminally on short side branches of a main hyphal strand, two to three frequently occurring on a somewhat short length of hypha. They were not cut off from the mother hypha by a septum. They proliferated freely, five successive structures sometimes being produced. Free swimming zoospores were produced in 20 to 30 minutes, sometimes less, after initial vacuolation of the prosporangium. A thin-walled

vesicle was extruded, into which the protoplasm passed before the swarm spores became differentiated. No sexual bodies were observed in agar culture or diseased roots. In old diseased roots prosporangia appeared as globose, empty cells with a well-defined wall, and averaged 24·6 by 22·4 μ (wall 1·6 μ thick), closely approximating in size to the average for sporangia produced in the laboratory. The best method of control would appear to consist in improved cultural practices, especially the drying and deep ploughing of the land.

Vascular necrosis of taro corms [loc. cit.] has never been reproduced under laboratory conditions and is not attributable to any specific organism. Unfavourable growing conditions causing the roots to die appear to be responsible, the necrosis then spreading to the interior of the corm along the vascular system. Planting material from non-submerged soil in which the condition does not occur shows 15 to 30 per cent. disease when planted in submerged soil, while material from diseased corms planted in non-submerged soil does not develop the disease. Experimental evidence showed that the varieties Mana Uliuli, Mana Ulaula, Mana Ulu, Mana Eleele, and Kai Kea are apparently immune from vascular necrosis, while Kai Uliuli, Ulaula Kumu, and Kakakura-ula are highly resistant. No variety had under 10 per cent. soft rot, but Moi, Ohe, Oene, Palaii, Kai Uliuli, Kumu Eleele, and two unclassified varieties had under 20 per cent. Kai Uliuli combined resistance to both diseases and gave the highest yield.

Ergot (*Claviceps paspali*) [ibid., xviii, p. 529] of *Paspalum dilatatum* and *P. orbiculare* was observed near Makawao, Maui, in December, 1937, and has since been found in various districts. Other records include stem canker and fruit rot of loquat due to *Botryosphaeria ribis chromogena* [ibid., xvii, p. 755], fruit spot of chilli (*Colletotrichum nigrum*) [ibid., xvii, p. 346], tomato fruit rot (*C. phomoides*) [ibid., xvi, p. 419], and leaf spot of lucerne (*Phyllosticta medicaginis*) [ibid., xviii, p. 397].

Dowson (W. J.). **On the systematic position and generic names of the Gram-negative bacterial plant pathogens.**—*Zbl. Bakt.*, Abt. 2, c, 9–13, pp. 177–193, 1939.

From a detailed examination of the cultural and biochemical characters of a large number of Gram-negative bacterial plant pathogens (only about seven of 100 carefully authenticated organisms being Gram-positive), the author found that they could be arranged in three distinct groups, (*a*) those like *Bacterium coli* and producing acid or acid and gas in salicin, (*b*) those like *Pseudomonas fluorescens*, failing to produce acid in lactose, maltose, and salicin but secreting fluorescin in certain media, and (*c*) those producing on solid media a most characteristic, abundant, slimy, yellow growth but failing to form acid in salicin.

The naming of these three groups necessitated an examination of the causes responsible for the present confusion in the classification of bacteria. The causes are stated to be (1) the use of more than one system of classification in which the same generic name has been differently applied, e.g., *Bacterium* and *Bacillus* of Migula, Smith, and Lehmann and Neumann; (2) the erection of a genus on one character alone, either non-motility, e.g., *Bacterium* Migula and *Aplanobacter*, or

pathogenicity, e.g., *Erwinia* and *Phytomonas*, neither of which is justified; and (3) failure to appreciate the significance of the Gram reaction which indicates a fundamental difference in the proteins of the two groups and probably absence of relationship. The genera *Listerella* and *Kurthia*, with polar and peritrichous flagella, respectively, have been founded by animal bacteriologists for Gram-positive, non-sporing rods, but it is not known how close to them is the relationship of the plant pathogens with these characters.

From a consideration of these points the author considers that since *Bacillus* has now been defined to exclude non-sporing rods and *Phytomonas* is suppressed as a homonym [*R.A.M.*, xviii, p. 597], only *Bacterium* Lehmann and Neumann and *Pseudomonas* Migula are applicable as generic names to the Gram-negative plant pathogens. *Bacterium* is applied to group (*a*), the other characters of the genus being as follows: non-sporing, rod-shaped, Gram-negative bacteria, motile by means of peritrichous flagella, or non-motile, grey or transparent on nutrient agar, forming creamy, later yellowish, growths on potato. *Pseudomonas* Migula is applied to group (*b*), comprising non-sporing, rod-shaped, Gram-negative bacteria, motile by means of polar flagella, 1 to 7 (average 3) in number, never non-motile when young, white or transparent on beef infusion and on starch agar, in both of which fluorescin is produced by most species, forming creamy, later pink, growths on potato. *Xanthomonas* n.g. is proposed as a name for the group (*c*) and is defined as non-sporing, rod-shaped, Gram-negative bacteria, uni- or rarely biflagellate or non-motile, forming abundant yellow, slimy colonies on nutrient agar and potato, and mostly digesting starch and producing acid in lactose but not in salicin. The type species is *X. hyacinthi* and other species transferred to the genus are: *X. campestre*, *X. phaseoli*, *X. stewarti*, *X. vasculorum*, *X. juglandis*, *X. malvacearum*, *X. pruni*, *X. citri*, *X. translucens*, *X. hederae*, *X. vesicatorium*, *X. cucurbitae*, *X. papavericola*, *X. ricinicola* (=*X. ricini*), *X. geranii*, and *X. flavozonatum*.

Khudyakoff (Y. P.) & Raznitzyna (Mme E. A.). Применение миколитических бактерий путем бактеризации семян при яровизации. [The use of mycolytic bacteria for the inoculation of seed during vernalization.]—*Bull. Acad. Sci. U.R.S.S., 1939*, Sér. biol., 1, pp. 117–120, 1939.

The use of mycolytic bacteria for the prevention of fungous infection during vernalization of cereal seed-grain was demonstrated in pot experiments with spring wheat Caesium 0111 and *Fusarium graminearum* [*Gibberella saubinetii*]. The grain yields of plants grown from seed soaked for 24 hours in a liquid culture of mycolytic bacteria F–80, in a water suspension of *G. saubinetii*, or in a mixture of the suspension of the fungus with the bacterial culture or a filtrate of it was 126·6, 26·9, 128·6, and 115·5 per cent., respectively, compared with 100 per cent. in the control plants raised from seed soaked in water. Similar results were obtained with the bacterial isolation F–24, but it reduced the yield of straw below that of the control. In inoculation experiments made in many replications seed-grain treated with mycolytic bacteria, particularly F–80, was not attacked by *G. saubinetii*, while that left

untreated invariably became infected and perished soon after germination.

Simmonds (P. M.). **A review of the investigations conducted in Western Canada on root rots of cereals.**—*Sci. Agric.*, xix, 9, pp. 565–582, 1939.

In this paper, to which a bibliography of 134 titles is appended, the history of investigations on root rots of cereals in Europe and the U.S.A. is outlined and a review is given of the work done in Western Canada on the take-all root rot (*Ophiobolus graminis*) [*R.A.M.*, xviii, p. 585], browning root rot (*Pythium arrhenomanes* var. *canadense* [ibid., xvi, p. 308] and *P. volutum*) [ibid., xvii, p. 735], and common root rot (*Helminthosporium sativum*, *Fusarium culmorum*, and *F. graminearum* [*Gibberella saubinetii*]).

Lange-de la Camp (Maria). **Die Weizen der deutschen Hindukusch-Expedition 1935.** [The Wheats of the German Hindu Kush expedition, 1935.]—*Landw. Jb.*, lxxxviii, 1, pp. 14–133, 35 figs., 2 graphs, 5 col. maps, 1939.

This is an exhaustive description of the writer's examination of the wheat plants raised at the Halle Plant Breeding Institute from nearly 850 samples of seed-grain collected by the German Hindu Kush expedition of 1935. The account includes full particulars of the reaction of the stands to spontaneous and artificial infection by certain important diseases.

Bayles (B. B.) & Taylor (J. W.). **Wheat improvement in the eastern United States.**—*Cereal Chem.*, xvi, 2, pp. 208–223, 1 map, 1939.

In connexion with a discussion of the wheat improvement programme for the eastern United States, the writers tabulate and comment upon the losses caused by the operation of various adverse factors, including fungal diseases. The average yield reductions (mostly in the soft red winter varieties) from stem and leaf rusts [*Puccinia graminis* and *P. triticina*: *R.A.M.*, xviii, pp. 94, 299, 384, *et passim*] from 1909 to 1937 were 2,944,000, 1,844,000, and 2,169,000 bush. (10·7, 5·4, and 5·1 per cent) for Missouri (30 per cent. in 1937), Illinois, and Ohio, respectively, other States suffering less severely, and two (Delaware and New Jersey) being practically free from the diseases in question throughout the period under review. Breeding for resistance to *P. graminis* and *P. triticina* has made much greater progress in the hard red spring than in the winter wheats. Thatcher, for instance, which has been grown commercially since 1934, sustained very little loss in the severe rust epidemics of 1935 and 1937 [ibid., xviii, p. 374], and other new hybrids, not yet available for distribution, are even more resistant. Two specially interesting crosses are Hope × Hussar (C.I. 11682) and Mediterranean × Hope (C.I. 11763), both of which are highly resistant to *P. graminis* and *P. triticina* and are undergoing further crossing with commercial soft red types to develop lines combining this quality with other desirable features. Wabash (C.I. 11384) is being recommended for Indiana and Illinois.

The heaviest average losses (2 to 2·6 per cent.) from loose smut [*Ustilago tritici*] during the years 1917 to 1936 occurred in the foothills

and mountainous areas of North Carolina, Kentucky, Maryland, Arkansas, Georgia, Pennsylvania, West Virginia, and Virginia. In the other twelve States under observation the reductions ranged from 0·7 (Delaware) to 1·8 per cent. (Michigan). Until recently, breeding for resistance to loose smut [ibid., xvii, p. 509; xviii, p. 447] was given little consideration, but an improvement in the method of flower inoculation has facilitated the approach to this problem.

During the period from 1928 to 1936 the heaviest yield reductions in soft red winter wheats from bunt (*Tilletia levis* [*T. foetens*] and *T. tritici* [*T. caries*: ibid., xviii, pp. 170, 441, *et passim*]) among the carloads examined at the terminal markets occurred in material from Maryland and Pennsylvania (22 and 14·6 per cent., respectively, graded bunted), the corresponding figures for Michigan, Ohio, and Indiana being 2·4, 2·2, and 2 per cent., respectively, and the total for all States 3·2 per cent.

Other diseases demanding special attention in certain areas are mosaic [ibid., xvii, p. 378] in southern Indiana and Illinois, leaf spot (*Septoria tritici*) [ibid., xviii, p. 297] and glume blotch (*S. nodorum*) [ibid., xiv, p. 348] in the Atlantic Coastal Plains region, and scab [*Gibberella saubinetii*: ibid., xvi, p. 374] in the Corn Belt.

Derzhavin (A. I.). Результаты работ по выведению многолетних сортов Пшеницы и Ржи. Тезисы. [Results of work on breeding perennial varieties of Wheat and Rye. Theses.]—*Bull. Acad. Sci. U.R.S.S., 1938*, Sér. biol., 3, pp. 663–665, 1938. [Received 1939.]

An amphidiploid plant with 42 chromosomes was obtained by crossing the wheat *Triticum durum* var. *leucurum* 1364/1 with the perennial rye *Secale montanum*, and from this hybrid several thousand plants have been obtained of which only six have a tough rachis and are being further selected. They appear to be immune from yellow and black rusts [*Puccinia glumarum* and *P. graminis*], highly resistant to brown rust [*P. triticina*], and so far free from bunt [*Tilletia caries* and *T. foetens*] and smut [*Ustilago tritici*]. The hybrid progeny cross readily with hard and soft wheats.

Steiner (H.). **Über die Verbreitung der Berberitze (Berberis vulgaris L.) in der Ostmark.** [On the distribution of the Barberry (*Berberis vulgaris* L.) in the Ostmark.]—*Landw. Jb.*, lxxxviii, 1, pp. 1–11, 1 map, 1939.

This is a detailed account of the distribution of the barberry in the Ostmark [Germany, formerly Austria] based on a recent survey by phytopathological experts of the Vienna Agricultural Institute with a view to the control of black rust of cereals (*Puccinia graminis*) by the eradication of the alternate host [*R.A.M.*, xiii, p. 752].

Garbowski (L.). **Studia nad pszeniczną rdzą źdźbłową Puccinia graminis tritici (Pers.) Er. et Henn. w Polsce w okresie 1933–1937 r.** [A study on the stem rust of Wheat *Puccinia graminis tritici* (Pers.) Er. & Henn. in Poland during the years 1933–1937.]—*Prace Wydz. Chor. Szkodn. Rośl. państw. Inst. nauk. Gosp. wiejsk., Bydgoszcz*, 18, pp. 5–76, 7 pl., 1 map, 1939. [French summary.]

Forty-three samples of black rust of wheat (*Puccinia graminis*) collected in 20 different localities of Poland during the period 1933 to 1937

were tested for the presence of physiological races on the standard test varieties. The races 40, 21, 14, 17, 34, and 27 were found to be present and also a new race, from which Reliance and Kota were immune, while Vernal, Khapli, and Acme were highly resistant, Arnautka, Mindum, Spelman, and Kota moderately so, and Einkorn, Marquis, and Little Club slightly susceptible. In culture races 40, 14, 17, 34, and the new race formed the teleuto stage more or less readily about $3\frac{1}{2}$ to $4\frac{1}{2}$ weeks after inoculation, while race 21 only sometimes developed the teleuto stage and then after a longer period. Race 40, cultured on Little Club wheat, produced light brown, almost ochre-coloured uredospores, while those of races 21 and 14 approximated to coffee-brown. In cultures of race 17 some uredospores were darker than others and these lines proved to be more virulent on Vernal and Reliance, while the lines with the lighter coloured uredospores seemed to resemble in their reactions the line 17a, established by American investigators [*R.A.M.*, x, p. 169]. All the 64 Polish varieties of winter wheats tested proved to be susceptible to races 21, 14, 27 and particularly to race 40; of the 12 spring wheats tested, Ordynatka, Ostka Pulawska, and Ostka Hildebranda were resistant to races 40, 21, and 14, but slightly susceptible to race 27, whereas Kalinowiecka, Pulawska Twarda, and Sieburczyńska were resistant to race 27, but susceptible to races 40, 21, and 14.

McFadden (E. S.). **Brown necrosis, a discoloration associated with rust infection in certain rust-resistant Wheats.**—*J. agric. Res.*, lviii, 11, pp. 805–819, 4 figs., 1939.

When wheat varieties possessing a specific type of mature-plant resistance to stem rust (*Puccinia graminis tritici*), such as Hope and H–44, were artificially inoculated with the spores of the rust or exposed to natural infection, they developed a melanistic reaction or discoloration referred to as 'brown necrosis'. Brown or purplish-brown blotches appeared on the culms, peduncles, glumes, and rachises, and occasionally on the awns and leaf sheaths. The lower margins of the blotches on the stems, just below the nodes, were generally striated. Blotches were less frequently present on the sheaths, and often took the form of haloes surrounding chlorotic areas. The blotches generally became visible during the second week after heading, shortly afterwards turning dark brown or almost black; at this time, many of the plant cells developed necrosis. The discoloration usually reached maximum development in a given variety a few days after its first appearance, after which little further development occurred in the variety except on later maturing culms.

A review of the literature indicates that this brown necrosis has been confused with lesions produced by several different disease organisms, especially black chaff (*Bacterium translucens* var. *undulosum*) [see below, p. 665].

Two distinct types of mature-plant resistance to stem rust were found in segregates from an H–44—Marquis wheat cross, a 'photologic' (expressed only under high light intensity) and a morphologic. Brown necrosis developed only on plants with photologic resistance to stem rust. This may perhaps explain earlier reports of close but incomplete

linkages and associations between resistance to stem rust and susceptibility to so-called black chaff.

Inoculation tests with F_2 plants from a cross between H–44 and Marquis suggest that it may be practicable to use the brown necrosis reaction as an indicator for identifying plants with photologic resistance early in their development. As this determination can be made before blooming, it would facilitate breeding for rust resistance by the backcross method.

CHESTER (K. S.). **The 1938 Wheat leaf-rust epiphytotic in Oklahoma.**—*Plant Dis. Reptr, Suppl.* 112, 18 pp., 1 graph, 1 map, 1939. [Mimeographed.]

Mild winter and relatively high spring temperatures, coupled with a persistent spring rainfall, are thought to have contributed largely to the exceptionally severe epidemic of wheat leaf rust (*Puccinia rubigo-vera tritici*) [*P. triticina*] in Oklahoma in 1938, the crop being stimulated by these conditions to the rank, succulent type of growth most susceptible to infection. Large areas, moreover, were planted with the susceptible Turkey, Blackhall, Fulcaster, and Cheyenne varieties. The disease was the chief cause of the 25 to 30 per cent. reduction in the yield and quality of the crop.

YABLOKOVA (Mme V. A.). **Response of the mycelium of Ustilago tritici in Wheat grain to ultra-violet rays as dependent upon its condition.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxiii, 4, pp. 392–394, 1 fig., 1939.

The fluoromicroscopic method described in this paper for the detection of living mycelium of *Ustilago tritici* in wheat seed-grains should prove extremely useful for the study of fungi in the living tissue of the host plant where the method of vital staining is of no avail. The technique adopted consisted in inoculating seed-grain of the varieties Albosar, Lutescens 062, and Albidum 721 with *U. tritici*, keeping them in the thermostat at 26° to 28° C. for one to six days, cutting longitudinal sections through the centre of the embryo, immersing them in a drop of freshly prepared 0·005 per cent. solution of Kahlbaum's eosin yellow with 0·1N potassium nitrate for three minutes, and then thoroughly washing them in distilled water, and examining them in ultra-violet light with a fluorescent microscope. The mycelium of *U. tritici* was distinctly visible in the embryo, fluorescing with a bright canary-yellow hue against the pale greenish-yellow fluorescence of the embryo tissues. In seed-grain subjected to the standard wet thermal treatment for the control of the smut (four hours at 30° and eight minutes at 52°), the mycelium seemed to be intact and was growing in the embryo, but its fluorescence was weaker than in the untreated material. It is concluded that the mycelium of the smut is injured rather than killed by the treatment and dies at a later stage. Dead mycelium observed in the grain heated at a temperature of 55° showed a still weaker fluorescence and the hyphae had lost the purity of their colour. The method thus provides a means of distinguishing dead from living mycelium in the host plant.

Johnston (C. O.) & Lefebvre (C. L.). **A chlorotic mottling of Wheat leaves caused by infections of Tilletia laevis.**—*Phytopathology*, xxix, 5, pp. 456–458, 1 fig., 1939.

Attention is drawn to a chlorotic mottling of the foliage, especially the basal leaves, of greenhouse plants of the spring wheat varieties, Prelude, Webster, Warden, Pusa No. 4, and a selection from the cross Pusa No. 52 × Federation inoculated with *Tilletia levis* [*T. foetens*] at the Kansas Agricultural Experiment Station in 1935 and 1936, when a similar condition was observed in bunted greenhouse plants of the winter wheats, Turkey, Tenmarq, and Blackhull, and in various winter varieties in the field bunt nursery. In greenhouse experiments in 1936, mottling was observed in all but one of the inoculated plants of Pusa No. 4, Prelude, and Pusa No. 52 × Federation, whereas the only non-inoculated plants similarly affected were four of Prelude, two of which were attacked by loose smut [*Ustilago tritici*]. Under field conditions the foliar mottling caused by *T. foetens* is not so easy to identify as in the greenhouse, and should not be used alone as a method of predicting the extent of infection, though it may well serve as an auxiliary for this purpose, especially in spaced sowings and among hybrid families of marked susceptibility or resistance to bunt, as opposed to those of intermediate reaction.

Lal (A.). **Interaction of soil micro-organisms with Ophiobolus graminis Sacc., the fungus causing the take-all disease of Wheat.**—*Ann. appl. Biol.*, xxvi, 2, pp. 247–261, 2 graphs, 1939.

In a study in England on take-all disease [*R.A.M.*, xviii, p. 386] *Ophiobolus graminis* was most frequently isolated from infected wheat roots two to four weeks after inoculation, while later there was less mycelium present. The fungus persisted longer (over five months) in sandy and alkaline soils, disappearing after a few weeks from acid ones. Large numbers of micro-organisms, among which *Trichoderma lignorum* was prominent, were isolated from infected roots and the disappearance of *O. graminis* is ascribed to their activity. It is suggested that the persistence of *O. graminis* in sand is due to the comparative absence of soil organisms. When grown on agar in the same Petri dish with *O. graminis*, especially in acid media, *Fusarium culmorum*, *Rhizoctonia* sp., and a strain of *T. lignorum* produced a staling effect on *O. graminis* at a greater distance between the two colonies (1·5 cm. and over) than any other organism tested and finally completely overgrew it and inhibited its growth. In soil cultures the growth of *O. graminis* after ten days' incubation at 25° C. was 3·56 cm. in the absence of soil organisms, nil in the presence of certain of them, and 1·3 to 0·1 cm. in that of others. In media to which filtered cultural solutions of various soil fungi and bacteria were added, the growth of *O. graminis* was either completely inhibited, retarded, or unaffected, the addition of nutrients or dilution making little difference, while boiling repressed the inhibiting effect in one case only. This inhibiting or retarding effect of the soil organisms is considered to be induced by their metabolic products. *Ophiobolus* mycelium subjected for five to eight days to contact with the staled media of certain fungi was rendered non-pathogenic, while others had little or no effect. The antibiotic effect of the various

organisms on *O. graminis* in soil was found to range from nil to complete inhibition of its pathogenicity.

HANNA (W. F.). **Coprinus urticaecola on stems of Marquis Wheat.**—*Mycologia*, xxxi, 3, pp. 250–257, 2 figs., 1939.

Coprinus urticaecola, with which *C. phaeosporus* and *C. brassicae* are considered to be synonymous, was found at Winnipeg in 1934 forming fruit bodies on the leaf sheaths of green plants of Marquis wheat near ground-level, and again in 1937 on decaying nettle stems. Fruit bodies of the fungus were produced by diploid cultures of the mycelium on sterilized soil, horse dung, or old wheat stems, but failed to appear on wheat plants inoculated with pure cultures of the mycelium in the greenhouse. The species is described and illustrated.

FRÖIER (K.). **Brunfläcksjuka (Bacterium translucens var. undulosum) och dess angrepp på olika Vetesorter.** [Brown spot disease (*Bacterium translucens* var. *undulosum*) and its pathogenicity to different Wheat varieties.]—*Nord. JordbrForskn., 1938*, 4–7, pp. 536–543, 1938.

Details are given of the reaction to black chaff of wheat (*Bacterium translucens* var. *undulosum*) [*R.A.M.*, xvii, pp. 16, 384, 435, 509] in hybridization experiments carried out at Svalöf, Sweden, from 1918 to 1922 (between Brown Schlanstedt and 0715, a selection from Börsum) and again in 1937 (using Extra Club II × Aurora and others), the outcome of which demonstrated the hereditary character of relative resistance (for immunity does not appear to exist) to the disease. Of the varieties used in the 1937 trials, a high degree of susceptibility was manifested by Atle, while Fylgia, Extra Club, and especially the newly developed Diamond (all spring wheats) were very resistant.

FISCHER (G. W.). **Studies of the susceptibility of forage grasses to cereal smut fungi. II. A preliminary report on Ustilago hordei and U. nigra.**—*Phytopathology*, xxix, 6, pp. 490–494, 1939.

The preliminary results of the author's studies in Washington on the spontaneous infection of *Agropyron cristatum* and *Elymus glaucus jepsoni* by the covered smut of barley (*Ustilago hordei*) [*R.A.M.*, xvii, p. 825] are presented.

Three collections of the smut from these two hosts and one from Beldi Giant barley were grown on potato dextrose agar, and monosporidial cultures of opposite sex, together with similar material of *U. levis* [*U. kolleri*], used for the cross-inoculation of Canadian oats and Beldi Giant and Trebi barley. Both the latter contracted smut from each of the three grass collections of *U. hordei*, from the Beldi Giant strain, and from all the crosses between the collections in every possible combination. Oats were infected only by *U. kolleri* without admixture. These data are considered to substantiate the morphological similarity to *U. hordei* of the covered smut on the two grasses under observation, if not to establish the identity of the barley and grass strains.

In inoculation tests on 25 grasses with each of the three grass collections of *U. hordei* and one from Beldi Giant barley, 10 to 50 per cent. infection was obtained on *A. caninum*, *E. canadensis*, *E. glaucus jepsoni*,

E. sibiricus, *Hordeum nodosum*, and *Sitanion jubatum*. Corresponding experiments with *U. nigra* resulted in 30 to 50 per cent. infection on *E. canadensis*, *H. nodosum*, and *S. jubatum*.

D'Oliveira (B.). **Estudos sôbre a Puccinia anomala Rost.** [Studies on *Puccinia anomala* Rost.]—*Agron. lusit.*, i, 1, pp. 64–86, 1939. [English summary.]

Continuing his studies on two of the physiologic races (12 and 17) of barley rust (*Puccinia anomala*) of English and Portuguese origin [*R.A.M.*, xviii, p. 387], the writer found that the uredospores were unable to germinate at 28° C. and that the mycelium succumbed when the host was continuously maintained at 30°. The duration of exposure to a given temperature evidently plays an important part in the reaction of the different physiologic races to this factor, the mean temperature in itself being of relatively slight significance. Darkness did not affect uredospore or aecidiospore germination or the entry of their germ-tubes into the host tissues, but considerably modified the expression of the symptoms in different varieties: for instance, in the resistant *Hordeum vulgare speciale* and Egyptian 4-rowed the pustules were larger than in the controls exposed to the light, while in susceptible varieties the infected areas were of an undiluted green in the midst of the surrounding chlorotic tissues. Uredospore germination and barley leaf infection took place at a relative humidity range from 72·5 to 100 per cent. It is apparent from these data that strict precautions should be taken for the maintenance of uniform environmental conditions in studies on physiologic specialization in *P. anomala*.

Dimitrieva (Mme T. I.). **The main results of breeding work at the Kharkoff Station.**—*Breed. Seed Gr., 1938*, 12, pp. 4–7, 1938. [Russian. Abs. in *Plant Breed. Abstr.*, ix, 3, p. 308, 1939.]

Among the most promising of the hybrid barley selections developed at Kharkoff [Ukraine] are the progeny of crosses between Nutans 0353/133 and Medicum 026, Medicum G. 78, and Nudum 25–5, all of which combine high resistance to *Helminthosporium* [*gramineum*: *R.A.M.*, xvi, p. 165] with various desirable commercial qualities.

Soukhoff (K. S.) & Vovk (A. M.). 'Закукливание' Овса, его вредоносность и пути распространения в природе. [The injuriousness of 'zakooklivanie' of Oats and the mode of its dissemination in nature.]—*Bull. Acad. Sci. U.R.S.S., 1939*, Sér. biol., 1, pp. 121–144, 6 figs., 1 diag., 1939.

This is an expanded account of work at Omsk on the mosaic disease of oats, called 'zakooklivanie' [pupation] disease, most of which has already been noticed in this *Review* [*R.A.M.*, xviii, p. 297]. Attempts to transmit the disease by sap inoculation and grafting gave negative results, and no evidence was obtained of its transmission through the soil or by seeds. The disease seemed to be least serious in oats sown in dense rows and at the end of May precisely.

HOFFMANN (W.). **Neuere Untersuchungen über die Ursache der Urbarmachungskrankheit und die Wirkung des Kupfers als Spurenelement.** [Recent investigations on the cause of reclamation disease and the effect of copper as a trace element.]—*Bodenk. u. PflErnähr.*, N.F., xiii, 3–4, pp. 139–155, 2 figs., 1939.

Further proof was afforded by the writer's experiments at the Prussian Moorland Experiment Station, Bremen, of the indispensability of copper in the prevention and control of reclamation disease of oats [*R.A.M.*, xviii, p. 613]. The same symptoms developed in plants in water cultures from which copper was rigorously excluded as are commonly observed in nature on the particular types of moorland soil conducive to the disease. Even the traces of copper present in ordinary distilled and tap water sufficed to exert a remedial effect. The plants also responded to the application of copper by way of the leaves. The reclamation disease symptoms were further induced when humic acid was added to sand treated with hydrochloric acid. The beneficial influence of protracted heating of the soil (7 to 10 days at 110° C.) on the course of reclamation disease was shown to be due to the increase of the water-soluble fraction of the copper by this process. It is apparent from these studies that copper, even in infinitesimal amounts, plays the part of a basic nutrient element in relation to the prevention of reclamation disease.

NICOLAISEN (W.), SEELBACH (W.), & LEITZKE (B.). **Untersuchungen über die Bekämpfung der Heidemoorkrankheit mit Kupferschlacke.** [Investigations on the control of reclamation disease with copper slag.] *Bodenk. u. PflErnähr.*, N.F., xiii, 3–4, pp. 156–169, 5 figs., 1939.

A detailed, tabulated account is given of one year's experiments at the Kiel (Schleswig-Holstein) Institute for Fodder Crops in the control of reclamation disease of Victory oats [see preceding abstract] by the application to the sandy humus soil of copper slag at the rate of 9 doppelzentner [900 kg.] per hect., which proved fully equal or even superior in its beneficial action to the maximum dose of copper sulphate (100 kg. per hect.). In some cases slag at the rates of 300 and 600 kg. per hect. gave results equivalent to those obtained with 50 and 100 kg. copper sulphate. No adverse influence on the yellow lupin [*Lupinus luteus*] crop succeeding oats was exercised by the copper sulphate or slag treatments, which in fact tended to stimulate flowering and so to increase the yield of dry substance. Favourable effects were also produced by the copper slag treatment in supplementary tests on rye and mangolds. It is pointed out that these experimental data are not necessarily applicable at the present stage to slags in general. The exact composition of the product in use (supplied by the North German Refinery, Hamburg), is known: it contains, in addition to 0·41 per cent. copper, a number of other elements in appreciable amounts (e.g., 39·4, 45·33, 5·70, 1·90, 0·33, 0·50, and 2·56 per cent., respectively, of the silicon, ferrous, calcium, zinc, manganese, magnesium, and aluminium oxides), any or all of which may be requisite for the optimal development of the crops. A minute quantity of lead (0·14 per cent.) is also present, the potentially deleterious effect of which on human or animal foods requires further investigation.

Steenbjerg (F.) & Boken (E.). **Karfosøg til Belysning af nogle Havresorters Gødskning med Mangansulfat.** [Pot experiments for the elucidation of the manganese sulphate fertilizing of certain Oat varieties.]—*Tidsskr. Planteavl*, xliii, 5, pp. 819–829, 4 figs., 1939. [English summary.]

The seven varieties of oats used in pot experiments in 1936 to determine the relationship between reaction to grey speck and soil treatment with manganese sulphate,[*R.A.M.*, xvii, pp. 82, 586; cf. also xviii, p. 88] fell into two groups, viz., three with light-coloured kernels, White Odal, Eagle, and Victory, which are very susceptible to the disease, and four relatively resistant with dark kernels, namely, Mesdag, Fyris, Bell, and Lyngby Heath. The manganese content of the ripe plants was found on analysis to be somewhat lower in the resistant than in the susceptible group, the averages detected in the kernels of the three yellow or white varieties in pots receiving 0, 0·25, and 2 gm. manganese sulphate being 11·7, 14·1, and 25·7 mg., and in the straw 18·5, 17·6, and 17·7 mg., respectively, the corresponding quantities for the black or grey being 10·9, 13·8, and 25·9, and 16·2, 16·1, and 15·8, respectively. The correlation between absorbed and added manganese, i.e., the coefficient of uptake, was found to be identical, practically speaking, in both groups, but the correlation between the yield of dry substance and absorbed manganese (coefficient of utilization) is highest in the resistant group receiving no additional manganese and declines with increasing supplies of manganese sulphate to the soil. The experiments further showed that during the first year (probably two or three years in the field), the proportion of manganese absorbed from a normal supply of manganese sulphate is only 3 to 4 per mille. The amount of manganese withdrawn from the soil by leaching out being inconsiderable, it is obviously necessary to devise some method of rendering the element physiologically available to the plants.

Pohjakallio (O.). **Resistensforädling mot Ustilago hos Havre.** [Breeding Oats for resistance to *Ustilago*.]—*Nord. JordbrForskn., 1938*, 4–7, pp. 516–525, 1 fig., 1938.

In inoculation experiments with *Ustilago avenae* on 18 varieties of oats at Jokioinen, Finland [*R.A.M.*, xvii, p. 309], in 1936 and 1937, Petkus Yellow and 094 (President) showed 1·1 and 1·2 per cent. infection, respectively, in the former year and remained immune in the latter, when 028 (Alahärmä) and Lischow Early were also free from attack. Low percentages of infection (2 and 2·7, respectively) were further shown by S. 171 (*Avena strigosa*×*A. brevis* from England) and Pflug's Early in 1937, while the other varieties all contracted the disease in a severe form in one or both years, with infection percentages ranging from 47·3 to 92·9 per cent. A number of crosses were also susceptible in both years, whereas Petkus Yellow×094, tested in 1937, developed only 6·8 and 5·9 per cent. infection (two inoculations). In tests to determine the influence of the host on the pathogenicity of the smut, the infection percentages on Nidar, Guldregn, and Pellervo with inoculum from Nidar were 98·7, 57·1, and 60·6; with mixed inoculum from the same three varieties and others, 71·4, 78, and 76·9; and from other varieties, 64·2, 69·1, and 63·4.

Voss (J.). **Zur Prüfung der Resistenz von Hafersorten gegen Flugbrand (Ustilago avenae [Persoon] Jensen).** [On the testing of Oat varieties for resistance to loose smut (*Ustilago avenae* [Persoon] Jensen).] —*Z. Zücht. A.*, xxiii, 1, pp. 20–46, 4 figs., 1 map, 1939.

A fully tabulated account is given of the writer's experiments at the Biological Institute, Dahlem, Berlin, covering the three-year period 1936 to 1938 on the varietal reaction of oats to loose smut (*Ustilago avenae*) [see preceding abstract], using Reed's method of testing [*R.A.M.*, x, p. 652; xviii, p. 304]. The discrepancies between greenhouse and field results observed in a number of cases are not considered to detract from the efficiency of the technique; infection almost invariably tended to be more severe under glass than in the open, and judgements on varietal reaction may therefore safely be based on individual performance under the former conditions.

Most of the loose smut collections (111 in all) originating in different parts of Germany during the period of the trials were only mildly pathogenic to the standard assortment of seven varieties used (Carsten's V, Krafft's Rhenish Yellow, Halle selection 2817, v. Lochow's Yellow, Strube's Schlanstedt Yellow, Lischow Early, and Rotenburg Black), with the exception of the highly susceptible Strube's Schlanstedt Yellow. Nine collections (Nos. 8, 23 to 26, 28, 36, 46, and 54) caused heavy damage on all varieties except Rotenburg Black and Halle selection 2817, which were also resistant (together with Carsten's V) to 38 and 51. No consistent correlation could be traced between the virulence of the collections and their geographical situation. Of the 41 varieties tested for their reaction to varying numbers (up to 59) of the collections during the three years of observation, two were adjudged to be fully resistant (Rotenburg Black and Black President) and six partially so, viz., Anderbecker, Carsten's V, Endress Franken, Krafft's Rhenish Yellow, Lischow Early, and v. Lochow's Yellow. Of 25 selections tested in 1937 and 15 in 1938, 25 and 33 per cent., respectively, were fully or partially resistant. These data are regarded as presenting hopeful possibilities of combating the weak physiologic races of *U. avenae* predominating in Germany by a rational breeding programme.

Hoppe (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1938 Corn crop.**—*Plant Dis. Reptr*, xxiii, 9, pp. 142–148, 2 graphs, 1939. [Mimeographed.]

The 1938 platings on potato dextrose agar of samples of damaged maize kernels taken from car-loads at terminal markets in the United States [*R.A.M.*, xviii, p. 17] yielded an unusually high proportion of *Diplodia zeae* [ibid., xvii, p. 811; xviii, p. 307] over a wide geographic range, the incidence of infection ranging from 0·3 per cent. in the west to nearly 60 in the east-central States. *Fusarium moniliforme* [*Gibberella fujikuroi*] and *F. moniliforme* [*G. fujikuroi*] var. *subglutinans* predominated in material from the southern, west-central, and western States, infection ranging from 12·7 per cent. (east-central) to 75 (Kansas and Nebraska). *G. saubinetii* was responsible for nearly 20 per cent. of the damage in the Atlantic coast States, and was also prevalent in southern Wisconsin and northern Illinois. *Nigrospora sphaerica* [ibid., xviii,

p. 18] was of little importance, the maximum of 3·5 per cent. occurring in Minnesota. As in 1937 [loc. cit.] the ratio of *Aspergillus* to *Penicillium* increased sharply in the comparatively dry western and south-western regions.

Notes are given on some regional differences in the fluctuations in the incidence of maize ear rots, illustrating the need for the accumulation of many years' data as a basis for serviceable conclusions regarding the relative prevalence of the various fungi concerned.

Rhoades (M. M.) & Rhoades (Virginia). **Genetic studies with factors in the tenth chromosome in Maize.**—*Genetics*, xxiv, 2, pp. 302–314, 1 pl., 1 diag., 1939.

Linkage data are presented which place the gene (designated *Rp*) for resistance to physiologic race 3 of maize rust (*Puccinia sorghi*) [*P. maydis*] in seedlings from New York at the extreme end of chromosome 10 (comprising 84 units) [*R.A.M.*, xiv, p. 626], the sequence and intervening map distance of six other genes being given.

Kernkamp (M. F.). **Genetic and environmental factors affecting growth types of Ustilago zeae.**—*Phytopathology*, xxix, 6, pp. 473–484, 2 figs., 1939.

The relative effects of genetic and environmental factors in the determination of the three growth types of maize smut (*Ustilago zeae*), viz., (*a*) strict sporidial, (*b*) fairly strict mycelial, and (*c*) intermediate, were studied at the Minnesota Agricultural Experiment Station [*R.A.M.*, ix, p. 713].

Type (*a*) could not be induced to form mycelium under any of the experimental conditions tested. Type (*b*) reacted to the admixture with the synthetic solution of 0·02, 0·5, or 1·5 per cent. asparagin or of 0·02 per cent. magnesium sulphate or potassium phosphate by the production of a few sporidia, which also followed the repeated supply of fresh nutrients. A similar but rather more active response to these stimuli was given by type (*c*). The growth types of the various lines of the smut used in the tests were not influenced by temperature, the hydrogen-ion concentration of the medium, or the development of 'staling' products. Segregation of factors for the sporidial and mycelial growth types occurred on individual promycelia in a sporidial × mycelial cross on a 4:0, 3:1, and 2:2 basis, denoting the existence of two or more factors for both sporidial and mycelial forms, of which only the latter is slightly susceptible to the operation of external influences.

Boewe (G. H.). **Diplodia ear rot in Illinois cornfields.**—*Trans. Ill. Acad. Sci.*, xxxi, 2, pp. 92–93, 1938. [Received July, 1939.]

During the period from 1928 to 1937 the average incidence of maize ear rot (*Diplodia zeae*) [see preceding page] in Illinois was 1·25 per cent. (0·14 per cent. in 1937 to 5·88 per cent. in 1930). In five of the ten years the percentage of ears with visible infection was above the average and in the other five below it. In 1931, 1936, and 1937 dry rot was found in less than 45 per cent. of the fields examined (only 12·7 per cent. in 1937). During the ten-year period 1·12 per cent. of the northern fields were infected, the corresponding figures for the central and

southern regions being 1·33 and 1·19, respectively. Infection by *D. zeae* is known to result from spores produced in old stalks and conveyed for distances of up to 350 ft. by the wind, so that the disease is likely to be most prevalent in the chief maize-growing regions, providing an abundance of inoculum from the previous season. The low incidence of ear rot in 1937 is attributed to the increase in hybrid maize acreage, viz., 15 per cent. or five times as much as was planted in 1936.

B[AKER] (R. E. D.). **Mycological note.**—*Trop. Agriculture, Trin.*, xvi, 5, p. 110, 1939.

In October, 1934, West Indian and T.I. limes growing in a nursery in a wet locality in Trinidad became infected by *Phytophthora parasitica*, which attacked and killed the soft green tissues of the young scions [cf. *R.A.M.*, xviii, p. 103]. The infected plants were destroyed, and the disease disappeared with the onset of the dry season. If citrus nurseries are supplied with excessive shade, heavy damage may result in wet weather.

TZERETELI (L. Y.) & TCHANTURIA (N. N.). Болезни плодов Цитрусовых при хранении. [Diseases of Citrus fruits in storage.]—*Sovetsk. Bot.*, *1939*, 3, pp. 111–115, 1939.

Under conditions of storage in the Georgian Socialist Soviet Republic (average temperature 4° to 5° C. and relative humidity of 85 to 88 per cent.) the following organisms were found causing rot in citrus (most of them recorded for the first time in Georgia): *Phytophthora* sp., *Rhizopus* sp., *Trichoderma lignorum*, *Aspergillus niger*, *A. glaucus*, *Penicillium italicum*, *P. digitatum*, *P. crustaceum*, *Sphaceloma fawcettii* [*Elsinoe fawcetti*], *Diaporthe citri*, *Phoma citricarpa* [*R.A.M.*, xvii, p. 742], *P. hesperidum*, *Septoria citri* [ibid., xvii, p. 311], *Colletotrichum gloeosporioides*, *Botrytis cinerea*, *Trichothecium roseum*, *Cladosporium herbarum*, *C. brunneoatrum*, *Alternaria citri*, *Fusarium poae* [ibid., xvii, p. 250], *F. sublunatum*, *F. sambucinum* f. 2 [ibid., xvi, p. 601], *F. anguioides*, and *Bacterium* [*Pseudomonas*] *citriputeale* [ibid., xviii, p. 445]. From observations made in the packing-houses at least 50 per cent. of the rotting was due to *Penicillium italicum* and 30 per cent. to *Botrytis cinerea*. According to data obtained from a phytopathological analysis during storage *P. italicum* was responsible for 60 to 70 per cent. of the rotted fruit and *P. digitatum* only for 5 per cent., although the latter was more active than the former in artificially infected fruit. Of all antiseptics tested an 8 per cent. solution of borax (exposure for five minutes at 41° to 43°) was the most effective in reducing the losses from *P. italicum* and *P. digitatum* [ibid., xvi, p. 602] but had little effect on those caused by other fungi.

FAWCETT (H. S.). **Scaly bark in relation to propagation of Citrus trees.**—*Calif. Citrogr.*, xxiv, 7, pp. 242–262, 1 fig., 1939.

The author cites several examples as evidence that psorosis of citrus in California [*R.A.M.*, xviii, p. 518] is spread by budding rather than from tree to tree in the orchard. None of the 350 Navel orange trees in a block at the Citrus Experiment Station, all propagated from the disease-free tree 'Abe Lincoln', showed psorosis [in 1939] though five Valencia orchards in Orange county, experimentally budded from a

diseased orchard, were totally infected. In Ventura county a block of Valencias budded from a diseased parent exhibited 97 per cent. psorosis on the bark and 100 per cent. in the leaves, whereas next to it a block budded from a healthy parent had no psorosis. Lemons, as a rule, are stated to be more tolerant of psorosis than oranges, yet they are often badly affected, especially on sweet orange stock. A scheme for the registration of disease-free trees, suitable for purposes of propagation, has been initiated by the California Department of Agriculture, the essential requirements for registration being that orange trees are at least 15 years of age, have been thoroughly examined by an inspector for the absence of symptoms, and are growing sufficiently distant from diseased trees; in the case of lemon trees, at least ten buds must have been budded on at least five sweet orange stocks without producing symptoms of the disease.

Bitancourt (A. A.). **Antracnose do Limoeiro Galego.** [Lime anthracnose.]—*Biologico*, v, 3, pp. 52–54, 1 pl., 1939.

A brief account is given of lime anthracnose (*Gloeosporium limetticolum*) [*R.A.M.*, xvi, p. 784], which is stated to cause severe losses in certain districts of Brazil.

Bitancourt (A. A.). **A ascoquitose dos Citrus.** [The ascochytosis of *Citrus*.]—*Biologico*, v, 5, pp. 94–95, 1 pl., 1939.

Sweet and sour oranges, Sicilian lemons, tangerines, and pomelos are stated to be susceptible in São Paulo, Brazil, to infection by *Ascochyta citri* [*R.A.M.*, xiii, p. 90], the entrance of which into the epidermal tissues is facilitated by insect (*Melipona*) injuries. The fungus produces dark lesions of regular contour on the leaves and branches, the latter sometimes being completely girdled and dying off above the site of invasion.

Anagnostopoulos (P. T.). *Ἡ παρακμὴ τῶν Κιτρεῶν τῆς Κρήτης, αἴτια, μέσα προλήψεως καὶ θεραπείας.* [The decline of the Citron in Crete, cause, means of prevention, and cure.]—*Hort. Res., Athens, 1939*, 2, pp. 99–112, 5 figs., 1939. [English summary.]

Among the causes of the recent decline of the Cretan citron (*Citrus medica*) crop to a quarter of its normal production are stated to be gummosis (*Phytophthora*), root rot (*Armillaria mellea*), wither tip (*Colletotrichum gloeosporioides*), *Deuterophoma tracheiphila* [*R.A.M.*, xviii, p. 245], *Diplodia* sp., *Phomopsis* [*Diaporthe*] *citri*, *Phoma* sp. and *Bacterium* [*Pseudomonas*] *syringae* [ibid., xvii, p. 812], the symptoms and control of which are fully discussed.

Camp (A. F.) & Peech (M.). **Manganese deficiency in Citrus in Florida.** —*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 81–85, 1 fig., 1939.

Manganese deficiency symptoms on citrus growing in the field in Florida [cf. *R.A.M.*, xvi, p. 313; xvii, p. 519] take the form of a network of fine green veins on a light green background on the young, unfolding leaves. At this stage it is difficult to distinguish the symptoms from those of zinc deficiency. When the leaves have just become fully expanded light green areas are found between the main veins and dark

green areas along the veins. The pattern is much less definite in colour and form than that caused by zinc deficiency, and as the leaves harden it may disappear. If it persists throughout the life of the leaf, the light green areas assume a light bronze colour later fading to dull white or dull light green. This dullness is a distinguishing characteristic of the condition. Affected leaves do not develop narrowing as in zinc deficiency, and there is no bushy growth with very short internodes. In severe cases growth and foliage are reduced and affected trees generally produce light-coloured fruit. If zinc and manganese deficiency are both present on the same tree and the former predominates the symptoms of the latter may be almost completely masked; if the latter predominates, its symptoms are intensified and are likely to be mistaken for those of zinc deficiency.

Spraying in spring and summer with manganous sulphate and hydrated lime or lime-sulphur gave excellent results in under 30 days. Alkaline coastal soils should be treated yearly, in January or early February, with an application of manganese sulphate (65 per cent.) at the rate of 5 lb. per tree.

Russo (G.). **Italy : the 'fetola' or yellow spot of Citrus in Sicily.**—*Int. Bull. Pl. Prot.*, xiii, 5, pp. 106M–108M, 2 figs., 1939.

Attention is drawn to the alarming spread of 'fetola' or yellow spot of oranges in Catania and other parts of Sicily [*R.A.M.*, xviii, p. 307]. In some localities the reduction in yield of healthy oranges in the current season's crop is estimated at a fifth or even a quarter of the total. The circular or irregular, slightly concave spots, each from a few millimetres to several centimetres in extent, may number 40 or more per fruit. They present a dotted aspect, owing to the presence of oil-bearing glands which are not attacked. The penetration of air into the interglandular spaces causes desiccation of the oil and imparts a sulphur-yellow tinge to the tissues and a reticulate appearance to the spots. The disease generally begins in September and reaches a climax during the succeeding months. A similar disorder is stated to be prevalent in California, where it is known as 'fruit-spotting' and attributed to the attacks of *Empoasca fabae*. The same agent is probably responsible for the trouble in Sicily, especially in view of its prevalence near cotton fields. Control measures are briefly indicated.

Miller (E. V.) & Schomer (H. A.). **Physiological studies of Lemons in storage.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 432–434, 1939.

When green California lemons were stored at 32°, 36°, 40°, 50°, and 60° F. for 15 weeks and chemical analyses made of the peel and flesh of representative fruits before, during, and after storage, no relationship was found between sugar, acid, glucosides, and acetaldehyde, and the incidence of physiological disorders, but low reductase activity was shown by the peel of fruits stored at temperatures most conducive to pitting (40°, 36°, and 32°) [*R.A.M.*, xvii, p. 389].

Srinivasan (K. H.). **Progress Report of work done on the Coffee Experiment Station, Balehonnur, for the period 1932 to 1936.**—*Bull. Mysore Coffee Exp. Sta.* 18, 13 pl., 1 map, 1939.

In this report [cf. *R.A.M.*, xii, p. 435] the work of the Balehonnur

Coffee Experiment Station, Mysore, India, during the period 1932 to 1936 is briefly reviewed.

Vasudeva (R. S.) & Rafique (M.). **Studies on the root-rot disease of Cotton in the Punjab. VI. Chemical composition of healthy and diseased Cotton plants.**—*Indian J. agric. Sci.*, ix, 2, pp. 331–342, 1939.

Further studies on cotton root rot [*Macrophomina phaseoli* and *Corticium solani*: *R.A.M.*, xviii, p. 249] in the Punjab showed that reducing sugars and sucrose were higher in the roots, stems, and leaves of wilted plants than they were in the corresponding parts of healthy cotton growing in the same field. Total and ammoniacal nitrogen, iron, and the calcium to potassium ratio were significantly higher in diseased than healthy roots. The ratios of iron in the leaf to iron in the root, and of calcium in the leaf to calcium in the root were lower in diseased than in healthy plants. The ratio of potassium in the leaf to potassium in the root, on the other hand, was higher in diseased than in healthy cotton.

Peltier (G. L.), Schroeder (F. R.), & Wright (E.). **Distribution and prevalence of Ozonium root rot in the shelterbelt planting area of Oklahoma.**—*Phytopathology*, xxix, 6, pp. 485–490, 1 fig., 2 maps, 1939.

Using the methods described by the senior author for the determination of the distribution and prevalence of root rot (*Phymatotrichum omnivorum*) in the shelter-belt zone of Texas [*R.A.M.*, xvi, p. 454; xviii, p. 590], the writers conducted a detailed survey of part of a similar planting area in south-western Oklahoma, and here discuss their progress up to August, 1938. A sharp line of demarcation between infested and non-infested areas was a feature of the surveys in both States, possibly associated with temperature and soil factors. For instance, the northward extension of the rot to the foothills of the Wichita Mountains, Oklahoma, may be attributed to the protection afforded by these ranges from cold north winds. A correlation was further observed between types of natural vegetation and the incidence of *P. omnivorum*. Another outstanding characteristic of root rot is its tendency to accumulate from the headwaters of a creek down the drainage basin, as in Deep Red Creek, Oklahoma. The futility of clearing native infested areas for diversified farming has become obvious in both States. It is evident that surveys for root rot should be made before replanting shelter-belts, so that infested areas can be avoided or planted to resistant crops.

Presley (J. T.). **Unusual features in the behaviour of sclerotia of Phymatotrichum omnivorum.**—*Phytopathology*, xxix, 6, pp. 498–502, 2 figs., 1939.

In contrast to the sclerotia produced by many fungi, those of the cotton root rot fungus, *Phymatotrichum omnivorum* [see preceding abstract], seem capable of reproducing the fungus from every cell by a process of 'vegetative sprouting'. The new hyphae appear to be formed inside the cells, whose contents go through a process of disorganization and reorganization that results in the formation of new hyphae,

each of which can produce a mycelium. The following is the sequence of events within the cells. Complete nuclear disorganization is succeeded by the convergence of two of the dark-staining bodies (possibly nucleoli) scattered throughout the cells, coinciding with localized increased density of the cytoplasm and ultimately giving rise to the formation of hyphae, which break through the 'mother' cell wall. Some of the hyphal tips on emergence from the sclerotial shell have peculiar branches or appendages which soon become detached. The newly formed hyphae are multinucleate and agree in all particulars with those of the actively growing vegetative mycelium, imparting to the sclerotium the setose aspect typical of the germinating stage of the fungus.

KHAN (H.). **Notes on the diseases of Trout at the Mahili hatchery—Kulu (Punjab).**—*J. Bombay nat. Hist. Soc.*, xl, 4, pp. 653–656, 1939.

Excellent control of the disease caused by *Saprolegnia* [*R.A.M.*, xviii, p. 591] on trout and carp in the Punjab is stated to have been obtained by placing the fish for five to ten minutes, or until signs of distress are shown, in a salt bath (3 per cent. sodium chloride). Patches of skin overgrown by the fungus may be gently rubbed with cotton soaked in a 1 in 2,000 copper sulphate solution or common salt in vinegar or iodine.

DESCHIENS (R.). **Capture et destruction de larves de Strongylidés du Singe et du Bœuf par des Hyphomycètes.** [The capture and destruction of Strongylid larvae of the Monkey and Ox by Hyphomycetes.]—*Bull. Soc. Path. exot.*, xxxii, 4, pp. 394–398, 1939.

Further details are given of experiments in the capture and ingestion of nematodes by the predacious fungi *Dactylella bembicodes* and *Arthrobotrys oligospora* [*R.A.M.*, xviii, p. 520 and next abstracts], the larvae in the cases under discussion being *Oesophagostomum bifurcum* from the cynocephalous monkey (*Papio sphinx*) and Strongylidae from a calf. An abundant spore yield may be obtained from agar cultures in moist chambers in 10 to 15 days.

DESCAZEAUX (J.). **Action des champignons Hyphomycètes prédateurs sur les larves de certains Nématodes parasites des ruminants.** [The action of Hyphomycetous fungi preying on the larvae of certain Nematodes parasitic on ruminants.]—*Bull. Soc. Path. exot.*, xxxii, 5, pp. 457–459, 1939.

Evidence is presented showing that *Arthrobotrys oligospora* and *Dactylella bembicodes* [see preceding and next abstracts] are capable of capturing and consuming the larvae of the Trichostrongylidae infesting the alimentary canal of oxen and sheep, and it may be confidently assumed that the Metastrongylidae of these ruminants undergo ingestion in a similar manner.

DESCHIENS (R.). **Considérations relatives à la destruction des larves de Nématodes parasites par des Hyphomycètes prédateurs.** [Considerations relative to the destruction of the larvae of parasitic Nematodes by predacious Hyphomycetes.]—*Bull. Soc. Path. exot.*, xxxii, 5, pp. 459–464, 1939.

The writer summarizes and brings up to date the progress made in the practical application of the predacious fungi, *Arthrobotrys oligospora*,

Dactylella bembicodes, and *D. ellipsospora* to the capture and destruction of the larvae of nematodes of domestic animals [see preceding abstracts]. Aspects of the subject to be taken into consideration include the accumulation of sufficient spore material for large-scale treatment of infested fields and the possibilities of injurious effects of such inoculum on man, livestock, or the soil.

Bluncк (H.). **Natürliche Feinde und biologische Bekämpfung der Maikäferengerlinge.** [Natural enemies and biological control of Cockchafer larvae.]—*Z. PflKrankh.*, xlix, 5, pp. 338–381, 7 figs., 1939.

The writer summarizes and discusses the available information on the natural enemies of the cockchafer (*Melolontha melolontha*), among which are a number of fungi, including *Beauveria densa* [*R.A.M.*, xviii, p. 453]. *B. densa* has been reported in the literature on cockchafers from France, Germany (with Austria), Denmark, Sweden, Norway, Poland, U.S.S.R., Hungary, and Italy. Although there is no doubt that the fungus may decimate the larval populations of cockchafers under natural conditions, and epidemics have in fact recently been recorded in various parts of Germany, the writer is sceptical of its potentialities for artificial control on any considerable scale.

Kuhn (L. R.). **Growth and viability of Cryptococcus hominis at Mouse and Rabbit body temperatures.**—*Proc. Soc. exp. Biol., N.Y.*, xli, 2, pp. 573–574, 1939.

Mice were readily infected at the University of Chicago with strains of *Cryptococcus hominis* [*Debaryomyces neoformans*] isolated from human cases of *Torula* meningitis, subcutaneous tumour, and generalized infection [*R.A.M.*, xviii, p. 592]. Death occurred following a regular increase in the number of viable yeasts in the mouse organs, especially the brain and lungs. On the other hand, rabbits resisted infection and the number of viable yeasts steadily decreased. Six strains of group (3) cryptococci [ibid., xv, p. 153] isolated from man were grown on dextrose veal infusion broth (P_H 7) at temperatures between 99° and 107° F. At the higher temperatures fewer organisms were produced and the viable cells decreased in number (in one instance from 7,480 per cu. mm. after eight days at 99° to 0 at 107°). The optimum for *D. neoformans* would appear to be below the normal body temperature of either of the experimental animals (99·1° in mice and 103·15° in rabbits); in the case of rabbits there was a rise to 105° to 107° after injection with the fungus.

Reyer (W.). **Über die Vermehrung von Blastocystis in der Kultur.** [On the reproduction of *Blastocystis* in culture.]—*Arch. Protistenk.*, xcii, 2, pp. 226–244, 2 figs., 1939.

The author, on the basis of studies at the Karlsruhe (Germany) Institute of Tropical Hygiene, distinguishes three types of human *Blastocystis* [*R.A.M.*, xvii, p. 816], of which I corresponds to *B. hominis* [ibid., xvii, p. 111] and II and III to *B. gemmagina*. Monkeys also harboured types I and (?) II, whereas only the former was detected in rats and pigs. At 37° C. on a medium of 2 per cent. agar on which were

superimposed layers of (*a*) horse serum and buffered Ringer solution at P_H 7·5, and (*b*) paraffin oil, type I is characterized by small, mostly spherical elements, the largest seldom exceeding three or four times the diameter of the smallest, reproducing by binary fission or simple budding; II by large, mostly spherical bodies, the largest often far more than four times the size of the smallest, reproducing chiefly by multiple budding but sometimes as in I; and III by large, frequently much branched structures, reproducing mainly by budding, the buds often tapering at the site of abstriction. The multiple budding described by Schaudinn in connexion with *Entamoeba histolytica* is attributed (*Arb. Kaiserl. GesundhAmt.*, xix, p. 597, 1903) to confusion with *Blastocystis* type II. Neither endosporulation nor copulation was observed.

The specific structure, cultural reactions, and extreme frequency of *Blastocystis* as an intestinal parasite of man are considered to leave no doubt as to its independent existence, but its classification in the natural system of fungi must be deferred pending the observation of sexual organs: meanwhile it should be placed among the Fungi Imperfecti.

Kelley (W. H.). **A study of the cell and colony variations of Blastomyces dermatitidis.**—*J. infect. Dis.*, lxiv, 3, pp. 293–296, 1 fig., 1939.

The cell and colony characters of *Blastomyces* [*Endomyces*] *dermatitidis* [*R.A.M.*, xviii, p. 253] were found, in the writer's experiments at the Duke University (North Carolina) School of Medicine, to be strongly influenced by the agar concentration of the beef extract medium. Optimum growth was obtained on a substratum consisting of 3 gm. beef extract, 10 gm. peptone, 5 gm. sodium chloride, 10 gm. starch, 15 gm. agar, 5 to 10 per cent. fresh rabbit or swine serum, and up to 1,000 c.c. water, with a hydrogen-ion concentration of P_H 7·2 to 7·3, the cultures being incubated at 37·5° C. in a humidor. Under these conditions the fungus developed in the form of elongated, cylindrical cells and produced colonies resembling those of the smooth mutants of bacteria and yeasts, growth being about twice as rapid as on the ordinary blood-agar medium. With a proportion of agar exceeding 2 per cent. the development of the fungus was typically mycelial.

Fraser (P. K.). **Some figures on the incidence of dermatophytosis.**—*J. trop. Med.* (*Hyg.*), xlii, 10, pp. 141–144, 2 figs., 1939.

After citing statistics in evidence of the world-wide upward trend in the incidence of mycotic infections, with special reference to the British Navy (in which dermatomycoses have been separated from skin diseases as a whole since 1930), the writer gives the results of cultural studies (carried out in collaboration with Miss F. L. Stephens) on 16 of the most severely infected cases of ringworm of the foot out of 319 (51·3 per cent. of the total) showing lesions. The fungi isolated from ten of the patients were *Trichophyton rubrum* [*R.A.M.*, xviii, p. 523], *T. interdigitale* [ibid., xviii, p. 313] (two), *Corethropsis hominis* [cf. ibid., xiv, p. 105], and *Epidermophyton floccosum* [ibid., xvii, p. 819; xviii, pp. 110, 311] (alone in one instance and in company with *Aspergillus* sp. and *T. gypseum*, respectively, in two others).

Zündel (W.). **Die europäischen Epidermophytonpilze.** [The European *Epidermophyton* fungi.]—*Arch. Derm. Syph., Berl.*, clxxix, 1, pp. 1–57, 36 figs., 1939.

This is a comprehensive account, based on personal observations at the Berlin Dermatological Clinic and a wide survey of the pertinent literature, of the clinical, morphological, and cultural features of the European species of *Epidermophyton*, viz., *E. inguinale* [*E. floccosum*: see preceding abstract], *E.* [*Trichophyton*] *interdigitale* [loc. cit.], and *E.* [*T.*] *rubrum* [loc. cit.] (comprising the forms variously described as *E. plurizoniforme*, *E. lanoroseum*, and *T. pedis*) [*R.A.M.*, xvii, p. 818].

Grigoraki (L.). & David (R.). **Caractères biochimiques de Trichophyton lacticolor (Sabouraud, 1910).** [Biochemical characters of *Trichophyton lacticolor* (Sabouraud, 1910).]—*C. R. Soc. Biol., Paris*, cxxxi, 19, pp. 767–769, 1939.

Trichophyton lacticolor [*R.A.M.*, xvii, p. 746] was shown to possess a very active casease, peptonizing 10 c.c. milk in less than a fortnight, and a vigorous trypsin, the liquefaction of gelatine being accomplished in 36 days. The most pronounced colorimetric changes in the carbohydrates and glycerine solutions tested occurred after ten days, after which there was a gradual attenuation. The alterations were not remarkable, except in the case of mannose, which turned from violet-red to orange 101, and glycerine (purple 531).

Grigoraki (L.) & David (R.). **Caractères biochimiques d'Endodermophyton indicum (Castellani, 1911).** [Biochemical characters of *Endodermophyton indicum* (Castellani, 1911).]—*C. R. Soc. Biol., Paris*, cxxxi, 18, pp. 594–596, 1939.

Continuing their studies on the biochemistry of the dermatophytes [*R.A.M.*, xviii, p. 522], the writers found that the casease of *Endodermophyton indicum* [*Trichophyton concentricum*: ibid., xviii, p. 524] is relatively inactive, the period required for peptonization being 85 days, whereas its trypsin acts vigorously and rapidly, the liquefaction of an 18 per cent. gelatine solution commencing a few hours after inoculation; in this respect the fungus resembles *Achorion violaceum*. The intensive assimilation of glycerine is not, however, accompanied by a proportionate increase of growth, the diameter of the cultures after 60 days being only 48 mm. There were no striking colorimetric changes in the carbohydrate and glycerine solutions in which *T. concentricum* was grown at 35° C., another point of likeness to *A. violaceum*.

Catanei (A.) & Grenierboley (J.). **Étude de teignes de la peau observées au Tonkin.** [A study of the skin ringworms observed in Tonkin.]—*Arch. Inst. Pasteur Algér.*, xvii, 2, pp. 282–285, 1 pl., 1939.

Clinical details are given of four cases of ringworm in Tonkin, Indo-China, in males aged 25, 37, 17, and 21 years, two of which were due to *Trichophyton concentricum* [see preceding abstract] and two to *T. rubrum* [*R.A.M.*, xviii, p. 523]. Positive results were given in inoculation experiments with both organisms on monkeys (*M*[*acacus*] *inuus*) and guinea-pigs.

Henrici (A. T.). **An endotoxin from Aspergillus fumigatus.**—*J. Immunol.*, xxxvi, 4, pp. 319–338, 1939.

This is an expanded account of the writer's studies at the University of Minnesota on the endotoxin isolated from a strain of *Aspergillus fumigatus* originating in a chicken, and experimentally shown to be pathogenic also to rabbits, guinea-pigs, and mice [*R.A.M.*, xviii, p. 109].

Harris (L. H.). **Allergy to grain dusts and smuts.**—*J. Allergy*, x, 4, pp. 327–336, 1939.

A series of 13 cases of respiratory allergy due to grain dusts and smuts in Ohio is described. All the patients reacted positively to intradermal injections of wheat and oat dust, 'musty' samples producing much stronger effects than 'clean' ones; the former contained three to five times as much nitrogen as the latter. In practically every case reacting to the dusts a similar response was obtained to one or more smuts. Seven out of the 13 persons under observation reacted positively to *Ustilago tritici* [*R.A.M.*, xvi, p. 381], 7 each to *Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetens*: loc. cit.], 10 to *U. avenae* and *U. levis* [*U. kolleri*] (combined), 10 to *U. zeae* [ibid., xvii, p. 174; cf. ibid., xviii, p. 111], and 8 to *U. hordei*. Five of these patients also gave positive reactions to mould (*Alternaria*, *Helminthosporium*, *Chaetomium*, and *Hormodendrum*) spores [ibid., xviii, p. 254]. The symptoms were successfully reproduced by the instillation into the nostrils of untreated persons of concentrated grain dust and smut extracts.

Straib (W.). **Untersuchungen über den Wirtsbereich und die Aggressivität physiologischer Rassen von Melampsora lini.** [Studies on the host range and aggressiveness of physiologic races of *Melampsora lini*.]—*Züchter*, xi, 5, pp. 130–136; 6, pp. 162–168, 2 figs., 1939.

The method of inoculating flax cotyledons in the stage of incipient development was found to facilitate the determination of physiologic races of *Melampsora lini* [*R.A.M.*, xviii, p. 509] and of varietal reaction to the rust in the writer's experiments at the Gliesmarode (Brunswick) branch of the Reich Biological Institute.

Four physiologic races, differing in pathogenicity from those isolated by Flor in the United States [ibid., xvii, p. 530], were obtained from uredospore collections from Holland, Sweden, and Germany, while indirect evidence was also forthcoming for the occurrence of physiologic specialization among the South American strains. Two of the races tested (Swedish and German) attacked, in addition to *Linum usitatissimum*, its var. *crepitans*, *L. africanum*, *L. corymbiferum*, *L. floccosum*, *L. hirsutum*, *L. nervosum*, *L. pallescens*, and *L. tenue*. *L. tenuifolium* produced a moderately resistant type, while *L. narbonense* comprised both immune and susceptible varieties; 25 other species of *Linum* remained free from infection. The wild forms of flax occurring in Germany (except *L. tenuifolium*) do not appear to act as hosts of the specialized strain of the rust (var. *liniperda*) attacking *L. usitatissimum* [ibid., vii, p. 580]. Scarcely any of the cultivated fibre varieties except Weihanstephan 384 showed any appreciable degree of resistance to the four races of *M. lini* used in inoculation tests in the greenhouse at 18° C.,

though the Dutch race occasionally proved less virulent than the others. On the other hand, immunity from some or all the four races was exhibited by certain oil-yielding varieties, e.g., Buck 2/34, 3/34, 7/34, and 9/34, various forms of Estanzuela, Kenya C.I. 709, Klein Bh, M.A. 6903, Manchuria, Punjab, Red Wing C.I. 499, Sicily, Weimar (all blue-flowering), and the white varieties Alvarez Nieves, Argentine, Ottawa 770 B × Saginaw C.I. 687, and Ottawa 770 B × Winona C.I. 684. However, reference to Vallega's results in the Argentine [ibid., xvii, p. 530] shows that the South American varieties resistant to the European, North American, and Japanese races of the rust are susceptible to the Argentinian; evidently uniform resistance throughout the globe is very rare. Modifications were observed in the reactions of older plants towards the disease as compared with those of young material and seedlings.

Haasis (F. A.). **Studies on Narcissus mosaic.**—*Mem. Cornell agric. Exp. Sta.* 224, 22 pp., 2 pl. (1 col.), 1939.

Narcissus mosaic [*R.A.M.*, xvii, p. 684], referred to by various workers as 'grey disease', 'yellow stripe', 'broken', 'mottling', 't'grijs', and 'grauw' disease has been reported from Australia, England, Bermuda, Bulgaria, Holland, and the United States. The pattern on the leaf consists of light green to greyish-green or dull to bright yellow streaks parallel to the long axis of the blade. They may extend continuously from base to tip, but as a rule they are broken and coalesce into isolated islands approaching normal leaf colour. These symptoms are occasionally expressed only in the basal parts of the leaf, though often confined to the upper two-thirds. The two surfaces of an individual leaf may bear different patterns. Necrotic spots may be present, especially on the King Alfred variety. Distortion of the foliage is common; in King Alfred the leaves may be spirally twisted, while Victoria often shows a bend in the plane of the leaf. Epidermal roughening is another striking symptom; the Sir Watkin and Minister Talma varieties always show it, while in others it is less conspicuous. The roughened areas occur in narrow bands parallel with the blade, which, as a rule, coalesce, areas of considerable width thus becoming involved. In many varieties symptoms resembling those on the leaves occur also on the flower stems. On the perianth and cup the symptoms appear as opaque, frost-like streaks and blotches, or small, isolated spots. When the attack is severe, the greater part of these organs may be affected, but generally the perianth is more severely affected than the cup. The floral parts are occasionally distorted.

Diseased plants produce inferior flowers and bulbs. When practically healthy and mosaic stocks of the Sir Watkin variety were grown under comparable conditions for three consecutive years the percentage weight increases annually for the latter were, respectively, 58·3, 36·1, and 8·6 per cent., as against 73·9, 63·7, and 30·5 per cent. for the former.

Experimental evidence showed that the disease is caused by a virus transmissible by grafting parts of diseased bulbs on to healthy ones or by mechanically injecting or rubbing sap from leaves of diseased plants into or on leaves of healthy plants. Transmission by soil contamination or root contact is very improbable, and by root mutilation and cutting

or picking the flowers negligible. The virus does not appear to be transmitted through seed, but is perpetuated by the propagation of mosaic bulb stock.

Symptom expression varies widely with the variety, but intervarietal inoculations indicate that the disease is probably due to a single virus. The virus resisted ageing *in vitro* for at least 72 hours, was transmissible at a dilution of 1 in 100, was inactivated at a temperature between 70° and 75° C., and failed to pass through Pasteur-Chamberland filters L_2, L_5, and L_7. Other plants than narcissi [including daffodils] appear to be very resistant to, or even immune from, infection with the narcissus virus. The best means of control consists in roguing and destroying affected plants, or protecting healthy ones from inoculation by means of cheese-cloth cages.

Longrée (Karla). **The effect of temperature and relative humidity on the powdery mildew of Roses.**—*Mem. Cornell agric. Exp. Sta.* 223, 43 pp., 4 figs., 9 graphs, 1939.

Investigations [which are fully described] into the effect of temperature and relative humidity on the conidial germination, mycelial development, and sporulation of *Sphaerotheca pannosa* var. *rosae* [*R.A.M.*, xvii, p. 771; xviii, p. 463] showed that the minimum, optimum, and maximum temperatures for germination were 3° to 5°, 21°, and 33° C., respectively. At 3° to 5° haustoria were occasionally noted on detached young leaves, but no further growth occurred; from 6° to 10° mycelium was scanty; between 11° and 28° there was good mycelial development, while optimum growth occurred between 18° and 25°. At 30° to 31° haustoria were occasionally found, but no further formation was observed at 33° to 34°. No sporulation occurred at temperatures below 9° to 10° or over 27° to 27·5°. The greatest number of spores per conidiophore was found at 21° to 27·5°, though at the latter temperature rather few conidiophores were present. High germinability was most quickly reached at 24° to 27·5°, but the longest period of high germinability on a given leaflet occurred at 18° to 19°. Changes in temperature did not stimulate germination. Germinability was approximately and entirely lost by exposure for 24 and 48 hours, respectively, to 0°. At 21° germinability decreased rapidly with decreasing relative humidity. In general this was also true at 33° to 34°, but the periods of viability were briefer and the effect of the relative humidity was overshadowed by the adverse influence of the high temperature. At relative humidities of 99·8, 99·0, 98·0, 96·9, and 94·9 per cent. (at 25·17°) the percentage conidial germination on glass slides was, respectively, 25·8, 66·2, 63·1, 67·7, and 2·0, while at relative humidities of under 75 per cent. (at 21°) no germination occurred. High germination is considered to be merely a matter of proper humidity.

In the case of conidia dusted on leaves of rose shoots in a controlled environment germination declined as the atmospheric humidity was decreased, temperature being constant, but in general the spores germinated in very dry atmospheres. Germination was higher on young than on old leaves of the same variety, and on the under than on the upper surface. The evidence indicated that the relative humidity at the surface of rose leaves is very high, even in a dry atmosphere.

On young leaves of two varieties decreasing relative humidity gave sparser mycelial development and fewer conidiophores, but both mycelial development and sporulation occurred even at 21 to 22 per cent. relative humidity. Old leaves of the susceptibile variety Excelsa were less susceptible than young leaves, and their upper surface less susceptible than the under surface. Old leaves of the Pernet variety were resistant under all conditions.

Davis (W. H.). **A bud and twig blight of Azaleas caused by Sporocybe azaleae.**—*Phytopathology*, xxix, 6, pp. 517–528, 1 fig., 1939.

Cultivated and wild azaleas (*Rhododendron* spp.) in Massachusetts are stated to be in danger of extermination by the bud and twig blight caused by *Sporocybe azaleae* [*R.A.M.*, xii, p. 696], the relationship of which to *Ceratostomella ulmi*, the agent of Dutch elm disease, is a matter of topical interest. Like *C. ulmi*, *S. azaleae* plugs the vessels with tyloses so that necrosis results. Other symptoms of the azalea disease (for which the designation 'bud and twig blight' is preferred to bud blight, rot, or blast) include dwarfing, discoloration, and shrivelling of the floral buds, prevention of blossoming (98 per cent. of affected flower buds failing to open, leaf buds being less susceptible to infection), and girdling of the stems: in some plantings 60 per cent. of the shrubs were killed by the disease. Initial infection from coremiospores occurred in the axils of the lower bud scales, whence the germ-tubes penetrated the meristematic bud cone and the hyphae advanced through the flower, bract, leaf, and stem tissues into the bark and pith cells filled with stored starch grains, and traversed the vascular system and cortical parenchyma.

S. azaleae made good growth and sporulated on cooked substrata containing starches and sugars, the optimum hydrogen-ion concentration and temperature being near $P_H 6$ and 22° to 25° C., respectively. The outer zone of the colonies on potato dextrose agar is light to mouse-grey, the inner (sporulating) area olive-coloured and of a felty consistency. In nature the coremia of the fungus develop in the autumn in the form of grey, hair-like stalks about 1 mm. in height, bearing at their apices grey, knob-like heads composed of grey coremiospores. Later the coremia turn dark brown, imparting a spiny appearance to the buds. These organs were also formed on inoculated capsules stored in damp chambers. In artificial inoculations the most successful results were obtained by placing the inoculum in the axils and outer scale cups of buds; wounds in the bark also afforded a favourable entry. Azaleas inoculated with *S. azaleae* lived for about five years, during the last of which, however, they mostly remained leafless with green bark. Of the eight *R.* spp. inoculated, *R. arborescens*, *R. viscosum*, *R. californicum*, *R. catawbiense*, *R. maximum*, and *R. molle* were resistant or immune, *R. nudiflorum* and *R. canescens* susceptible. In experiments conducted in 1933 and 1935 the fungus remained viable in the host during each month of the year. As long as the inner bark remained green and intact the fungus could be cultured from infected dead twigs. In bud inoculations it advanced into the stem from 3 to 5 mm. in the first year and up to a decimetre in the second. Inoculations made in August and September gave the best results.

Good control was obtained by the pruning and destruction of diseased material and dusting with copper-lime dust 57 or spraying with Bordeaux mixture 5-5-50.

Pohlig (M.). **Beobachtung über eine Pilzerkrankung an Alyssum saxatile.** [Observation on a fungous disease of *Alyssum saxatile*.] —*Blumen -u. PflBau ver. Gartenwelt*, xliii, 21, p. 246, 1939.

Peronospora galligena [a specialized form of *P. parasitica*: *R.A.M.*, xvii, p. 824] was found to be the agent of numerous hemispherical, convex, or concave protuberances on the leaves of *Alyssum saxatile* in the Dresden district of Germany in 1938.

Diehl (W. W.). **Identity and parasitism of a species of Dothichloë.**— *J. agric. Res.*, lviii, 12, pp. 947–954, 1 pl., 1939.

Dothichloë limitata, formerly erroneously referred to *D. atramentosa* [*R.A.M.*, x, p. 389] but here established as a new species, is stated to occur on the leaves of various grasses, inducing sterility, in the south-eastern part of the United States and in North Dakota, also in Brazil, Surinam, and the West Indies. The fungus forms fructifications which are white at first and then black, up to 2 cm. in diameter on the upper leaf surface. The white stage bears conidia and is relatively conspicuous only when the leaves are distended, whereas the matured black ascostromata stand out plainly but finally slough off, leaving the leaf almost normal. Diseased plants are difficult to distinguish as the absence of inflorescences, the only readily recognizable symptom, easily passes unnoticed. The new species is described in Latin and English. The scolecosporous conidial fructifications are ephemeral, white to grey, with a palisade of conidia (18 to 30 by 1 to 2 μ), on short, simple conidiophores, rarely swollen and branched, sometimes coalescing to form a hymenium; amerosporous conidial fructifications, with simple to spatulate conidiophores, each with an apical sterigma bearing a single obovate conidium measuring up to 4 by 3 μ, develop under conditions of extreme moisture upon the immature ascostroma.

The ascostromata are uniformly effuse, maculiform, usually 10 to 15 mm. in diameter, sometimes separated into pulvinuli by sterile areas; the surface is uniform to rugulose, black, punctate from the slightly emergent ostioles; the context is white; and the perithecia are ovate to lageniform, 180 to 315 by 80 to 130 μ, the asci 105 to 160 by 4 to 6 μ, and the ascospores 90 to 120 by 1 to 1·5 μ. The new species is distinguished from *D. atramentosa* by the fact that it always occurs on the adaxial surface of the leaf, while *D. atramentosa* remains constantly abaxial. The results of inoculation experiments were unsuccessful, but observations in the field and greenhouse point to systemic infection. Low temperatures in the greenhouse (minimum of 7° C.) prevented the sporulation of the fungus but did not eliminate the infection. The effect of low temperatures may explain the predominantly southern distribution of the fungus, while in more northern regions it may be present in the grass tissue without producing any conspicuous symptoms.

Björling (K.). **Undersökningar rörande Klöverrötan. I. Infektionsförsök med Sclerotinia trifoliorum Eriksson. Förelöpande meddelande.** [Studies relating to Clover rot. I. Inoculation experiments with *Sclerotinia trifoliorum* Eriksson. Preliminary communication.]—*Medd. Växtskyddsanst., Stockh.*, 27, 24 pp., 2 figs., 1 graph, 1939. [German summary.]

Notwithstanding the fundamental difficulties [which are discussed] attendant on the differentiation of physiologic races of fungal pathogens on cross-pollinating plants, such as clover, the writer's inoculation experiments at Svalöv, Sweden, in 1938 with three isolates of *Sclerotinia trifoliorum* [*R.A.M.*, xviii, p. 628] on twelve strains of red clover [*Trifolium pratense*], including one each from Denmark and Germany, yielded the following information on the point in question.

The fungus was cultured on bread according to Rudorf's method [ibid., xvii, p. 185] and an aqueous suspension of the ground sclerotia plus 2 per cent. cane sugar and 0·5 per cent. agar inoculated into the plants on 1st and 15th July at 16° and 20° C., respectively. In the tests with the relatively mild Svalöv isolate the most resistant clover strains were two from Skåne (Harrie and Merkur) and one from Blekinge (Wambåsa), while the most susceptible were the German and two from north Sweden. Merkur was also very resistant to the more virulent isolates from Ultuna and Luleå. In a small-scale trial on four red clover clones with five isolates of *S. trifoliorum* individual differences in response were also detected, and the outcome of the experiments as a whole is considered to provide a basis for field observations on physiologic specialization within the fungus and variations in susceptibility to its attacks.

Klemm (M.). **Zur Kenntnis der wirtschaftlichen Bedeutung des Kleekrebses (Sclerotinia trifoliorum Eriks.) in Deutschland.** [A contribution to the knowledge of the economic importance of Clover stem rot (*Sclerotinia trifoliorum* Erikss.) in Germany.]—*Landw. Jb.*, lxxxvii, 6, pp. 839–893, 3 graphs, 19 maps, 1939.

The salient points of this exhaustive, fully tabulated and documented survey of the economic importance of clover stem rot (*Sclerotinia trifoliorum*) in Germany have already been noticed from another source [*R.A.M.*, xviii, p. 318].

Thomas (H. Earl) & Ark (P. A.). **Some factors affecting the susceptibility of plants to fire blight.**—*Hilgardia*, xii, 4, pp. 301–322, 2 figs., 1939.

In further studies on *Bacillus amylovorus* [*Erwinia amylovora*: *R.A.M.*, xiv, p. 702; xviii, p. 399] in California observations on the histology of the shoots of resistant and susceptible plants indicated that the size of the intercellular spaces is only a minor factor in determining the course of infection. Tissues with a high nitrogen content were more susceptible in general than the nearest comparable tissues with less nitrogen. Thus, for example, when 20 root-bound plants of *Pyracantha angustifolia* in pots of poor soil were selected in pairs and one of each pair received $\frac{1}{4}$ gm. of calcium nitrate, all the plants being inoculated at

the tip five days later, 13 days after inoculation the length of the blighted part averaged 5·9 in. for the treated plants and only 2·2 in. for the untreated. Other evidence suggested that the concentration of solutes in the nectar and perhaps in the plant sap, as affected by atmospheric humidity, is of importance in the penetration of the organism into the plant and the subsequent development of infection.

On girdled pear and apple trees the bark immediately above the point of girdling was more susceptible than that immediately below. Of 184 Yellow Newtown apple trees girdled on the upper trunks, 64 developed blight starting at the ring; 81 per cent. of the cankers spread farther above than below the ring, and 65 per cent. were confined to the bark above the ring, only 7 per cent. being entirely below. When inoculum was applied to the fresh girdling wounds on seedling pear trees, out of 37 infections 73 per cent. extended farther above than below the ring, and 24 per cent. were larger below the ring, the average length of the cankers being 3·27 in. above and 1·75 in. below the ring. The result of an experiment on *P. angustifolia* indicated that wounds became unfavourable to infection within 27 hours (0 out of 5 inoculations successful) and partially so in 6 hours (3 out of 15 successful compared with 18 out of 20 when inoculated on wounding). Tests for gums and suberins did not show the presence of these substances at the margins of wounds until after such wounds had ceased to be susceptible to invasion.

Etiolation had a relatively slight influence on infection, but defoliation reduced susceptibility. A relation of temperature to initiation of infection was indicated by the results of inoculations on the north and south sides of the trunks of seedling pear trees; the former showed 15 per cent. successful infections and the latter 28·5 per cent. Girdling cankers exposed to the sun were observed to advance during the winter months several inches more than those on the opposite side.

In the progeny of a hybrid of *P. angustifolia* (highly susceptible) and *P. gibbsii* var. *yunnanensis* (comparatively resistant) resistance appeared to be at least partially dominant. In the F_2 generation no relation was observed between susceptibility and resemblance to parents.

Heinicke (A. J.). **The influence of sulphur dust on the rate of photosynthesis of an entire Apple tree.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 202–204, 1939.

Continuing his earlier investigations [*R.A.M.*, xvii, p. 696] the author made a heavy application of finely divided sulphur dust on 9th June, 1938, to an 11-year-old Baldwin apple tree enclosed in a specially constructed glass assimilation chamber, a second tree of the same age remaining untreated in a similar chamber.

The results obtained showed that, as compared with the lime-sulphur solution applied in the previous year's experiment [loc. cit.], the sulphur dust had relatively little effect on the rate of photosynthesis of the leaves. During the five days following dusting the two trees showed practically no change in rate of photosynthesis. During the next ten days the average reduction in relative rates due to the treatment did not exceed 11 per cent., while from 24th to 28th June it was only about

6 per cent. The least reduction occurred during the five-day period when the average mean temperature was lowest, the data showing that temperature is a very important factor in determining the amount of injury caused by sulphur. During the eleven days when the temperature was under 90° F. the average rate of photosynthesis was 90·1 per cent. of the control, whereas on the nine days when it was over 90° it was only 79·9 per cent. The greatest reduction for any individual day occurred between 9·30 a.m. and 2.30 p.m. on 23rd June, when the average temperature was 96° and the activity of the dusted tree was 72 per cent. of the normal relationship. A comparison of the respiration rates during the night indicated that the differences then found would account for only a small part of those in the apparent photosynthesis during the day.

Brody (H. W.) & Childers (N. F.). **The effect of dilute liquid lime-sulphur sprays on the photosynthesis of Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 205–209, 8 graphs, 1939.

Experiments carried out in 1938 under greenhouse conditions demonstrated that dilute liquid lime-sulphur sprays applied to leaves of one-year-old Stayman apple trees by means of a hand atomizer at concentrations of 1 in 40 to 1 in 125 may markedly reduce the apparent rate of photosynthesis [see preceding abstract] for three to five days after application, even though no visible burning occurs. When the maximum temperature reaches 90° to 100° F. assimilation is, as a rule, significantly reduced, whatever the spray concentration. The rate of photosynthesis of the sprayed leaves became reduced during the first day after treatment, except in three experiments when it was reduced on the second day.

MacDaniels (L. H.) & Hildebrand (E. M.). **The effect of copper compounds applied to spur units during bloom upon the set of Apple fruits.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 230–233, 1939.

The results are given of experiments made to determine the specific effect on fruit set of copper-lime dust (20-80) and Bordeaux mixture (2-6-100) (the most practical materials for use on blossoming trees against fireblight [*Erwinia amylovora*: *R.A.M.*, xvii, p. 692]) applied to the stigmas of apple blossoms on spur units. In the first series data from six trees showed that the treated flowers set from 34 to 118 per cent. of the fruits of untreated controls. In a second series the set on the treated flowers (one flower on a spur being treated and the control left untreated) varied from 100 to 167 per cent. of that of the corresponding controls, the lighter set of the controls probably being due to competition for food and water between flowers on the same spur. In a third experiment treatment with bactericides at the time of pollination and 24 hours later resulted in no significant difference from the controls in the number of fruits set and the average number of seeds per fruit, but flowers pollinated 36 hours after treatment yielded less fruits and more seeds per fruit. The data presented support the view that these copper compounds may be applied to apple trees in blossom without seriously reducing fruit set.

Woodhead (C. E.). **Pruning in relation to 'mouldy core' of the Delicious Apple.**—*N.Z. J. Sci. Tech.*, xxa, 6, pp. 402–403, 1939.

No correlation could be found between various methods of pruning, drastic and conservative, and the incidence of mouldy core in 20-year-old Delicious apples in experiments at Henderson, Auckland, New Zealand, in 1936–7 [*R.A.M.*, xvi, p. 688].

Harley (C. P.). **Some associated factors in the development of water-core.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 435–439, 1 graph, 1939.

Observations on the prevalence of water-core [*R.A.M.*, xi, p. 55; xv, p. 302] were made on 13-year-old Delicious apple trees in the Wenatchee Valley, Washington, given (*a*) no fertilizer, (*b*) 4·5 lb. of nitrate of soda per tree on 27th May, (*c*) the same on 27th May and 30th July, and (*d*) the same on 30th July only, a 'wet' half of each plot being irrigated frequently, while the other half was kept 'dry', being irrigated only when the trees began to wilt. Throughout the summer branches from trees in all plots were bark ringed and leaf–fruit adjustments made to 10, 30, and 70 leaves per apple. At harvest, all apples from ringed branches and a representative number from the unringed were examined for water-core.

The data obtained showed that secondary factors are operative in the initiation of the condition. Leaf area appeared to be very important in this connexion. No water-core was found in fruits with ten leaves per apple, though exposure to the sun in the case of these fruits was at least as great as that of the apples grown with more leaves. Assuming temperature to be constant, the percentage of water-core was in general directly proportional to the number of leaves per apple.

Next in importance came the influence of nitrogen applied after completion of terminal growth. Double applications gave a higher percentage of water-core than either of the single treatments. Early applications tended to give more water-core than later ones in the case of apples from unringed branches with 30 leaves per apple.

On the whole, more fruits were affected in the dry than the wet plots, particularly with the '70 leaf' and unringed fruits.

These results show that factors closely associated with carbohydrate metabolism in apple leaves predispose the fruit tissues to water-core. Differences in the amount of water-core found in different orchards or trees of a given variety in the same locality may be attributable in part to differences in leaf–fruit ratios, in nitrogen content of the leaves, or both. The factor predisposing to water-core would appear to be primarily the photosynthetic activity of the leaf. Under the experimental conditions (with trees somewhat deficient in nitrogen), it is concluded that the higher percentages of water-core found in the nitrated plots were probably due to increase in the ability of the leaves, through added nitrogen, to synthesize and transport carbohydrates to the fruit.

Ward (K. M.). **Little-leaf—a functional disorder of Apple trees at Stanthorpe.**—*Qd agric. J.*, li, 5, pp. 458–473, 8 figs., 1939.

In experiments on the control of little leaf of apples [*R.A.M.*, xvii,

p. 692], carried out during the 1937–8 growing season at Stanthorpe, Queensland, to find out the best method of supplying zinc to the trees, definite response to zinc treatment was obtained only on trees which had received a dormant spray consisting of 50 lb. zinc sulphate in 100 gals. water, renewed growth following the application of the spray within about three months. None of the other treatments gave positive results, but it is thought possible that some response will appear during the second growing season. Zinc sulphate combined with lime-sulphur (10 lb. zinc sulphate, 5 lb. hydrated lime in 100 gals. water, together with the appropriate strength of lime-sulphur) is said to be a safe spray. The application of a mixture of zinc sulphate and lime either alone or in combination with lead arsenate was not observed to cause fruit russeting or foliar injury on apple trees.

Moore (M. H.). **Apple scab control. The problem, and some recent research findings as regards its solution.**—*Rep. E. Malling Res. Sta., 1938*, pp. 265–270, 1 chart, 1939.

This is a popular summary of the results of experiments on the control of apple scab (*Venturia inaequalis*) carried out at East Malling during recent years. (The article is reprinted from *The Fruitgrower*, lxxxvii, pp. 569–570, 1939.)

Gaudineau (Mlle [M.]), Raucourt, & Morel (G.). **Les tavelures du Pommier et du Poirier.** [Apple and Pear scab.]—*C. R. Acad. Agric. Fr.*, xxv, 20, pp. 687–693, 1939.

In this note, preceded by a foreword (pp. 686–687) by [G.] Fron, the writers describe their detection of the perithecial stages of apple and pear scab (*Venturia inaequalis* and *V. pirina*), the importance of which in the overwintering of the diseases has not hitherto been sufficiently recognized in France. In the case of apple scab, perithecia were observed in an orchard near Bavay (Nord) in January, 1939, and were subsequently found in profusion on material collected in Seine-et-Oise, Oise, Yonne, Ardennes, and Loire et Gironde, and also on foliage in Alsace. According to information from colleagues, perithecia were detected in Puy-de-Dôme in 1938, and the writers also found them on leaves gathered at Versailles in February 1938. At the end of April 1939 perithecia kept in the open showed evident signs of maturity, and on 9th May natural discharge was observed under the microscope. On the 12th, four hours after a heavy shower, ascospores were trapped on vaselined slides placed near infected leaves out of doors. These dates, coinciding with the apple blossom, may be taken as marking the inception of the critical period for infection in the Paris district. The 'pink bud' and 'open blossom' treatments are therefore of special importance in the spraying schedule.

Perithecia of *V. pirina* were observed from 22nd February, 1939, onwards in the Ardennes, at Versailles, in Oise, Seine-et-Oise, Alsace, and at Clermont-Ferrand. Ascospore discharge commenced on 10th May. The pear scab perithecia do not present the same practical interest as those of *V. inaequalis* in the over-wintering of the disease, the conidia of *V. pirina* being already in course of development on 21st

February and evidently playing the chief part in the dissemination of primary infection.

These observations further emphasize the need for stringent orchard sanitation to prevent the formation of cankers harbouring the perithecia during the winter, supplemented by the application of a standard fungicide as soon as the buds begin to swell.

Wormald (H.). **Bacterial rot of Cherry fruits.**—*Rep. E. Malling Res. Sta., 1938*, pp. 173–175, 2 figs., 1939.

The author states that bacterial spotting of cherry fruits has been observed in England on four occasions. On three of these (in 1931, 1933, and 1938) only single fruits were involved, but an outbreak in 1929 was sufficiently serious for the grower to inquire as to the cause. From the affected fruit *Pseudomonas prunicola* was isolated once, and *P. mors-prunorum* [see next abstract] three times. Infection of plums by *P. mors-prunorum* has been seen on two occasions, but the lesions on cherries were larger (up to $\frac{3}{4}$ of the surface) and more irregular than those on plums and somewhat sunken. Inoculations with either species isolated gave positive results. The fruit is probably infected by bacteria splashed by rain from lesions on the leaves and branches.

Wilson (E. E.) & Hewitt (W. B.). **Host organs attacked by bacterial canker of stone fruits.**—*Hilgardia*, xii, 4, pp. 249–255, 3 figs., 1939.

Organisms isolated at different times and in different parts of California from leaves, blossoms, blossom buds, fruit stems, fruit, and green terminal shoots of cherry, apricot, and plum trees affected with bacterial canker when inoculated into Bing cherry trees produced cankers identical with those caused by *Phytomonas* [*Pseudomonas*] *cerasi* [*R.A.M.*, xvi, p. 328] from limb canker of plum.

Evidence obtained showed that leaf, fruit, fruit stem, and green-shoot infections [the symptoms of which are discussed] did not contribute to the severity of epidemics, infections of these organs usually arising from bacteria originating in bud infections and twig lesions. Blossom and bud infections are often serious and develop concurrently with outbreaks of limb cankers. Such infections are a direct cause of crop loss, reduce the future fruitfulness of branches, and set up foci of infection from which the bacteria invade large limbs.

The symptoms described resemble those of bacteriosis of cherries [*P. prunicola* and *P. mors-prunorum*: ibid., xiii, p. 452; xviii, p. 122] and plums [*P. mors-prunorum*: ibid., xvii, p. 693] in England [see preceding abstract].

Wilson (E. E.). **Factors affecting development of the bacterial canker of stone fruits.**—*Hilgardia*, xii, 4, pp. 259–298, 3 figs., 6 graphs, 1939.

A study made in California of factors affecting the development of bacterial canker of stone fruits due to *Phytomonas* [*Pseudomonas*] *cerasi* [see preceding abstract] after infection has become established showed that canker activity begins in late autumn and ceases in early summer. Increase and decrease in the bacterial population are associated, respectively, with rise and fall in canker activity. Inoculation experiments showed that the period in autumn when cankers could be

obtained, and the period in summer when they could no longer be obtained, corresponded, respectively, with the periods when naturally occurring, established cankers began and ceased activity.

Low temperatures during midwinter resulted in decreased canker extension, while the rising temperature in spring was accompanied by increased extension. The failure to obtain cankers by inoculation in early autumn and early summer did not appear to be due to adverse temperatures, nor did differences in the rates of extension in two successive periods following inoculations seem to be associated with temperature variations. It seems that some factor exerts an influence during spring and becomes more marked as spring passes.

Moderately affected trees in sandy loam were benefited by applications of ammonium sulphate, which appeared to increase the ability of the trees to repair the injury caused by the disease. The evidence obtained indicated that lack of available soil moisture adversely affects the disease, though wide differences in soil moisture, not amounting to actual lack, do not influence the condition.

The severity of the disease in any locality depends on the varieties grown. A few varieties are resistant, more are highly susceptible, and most are intermediate. A distinction is drawn between susceptibility to infection and susceptibility to the inroads of the cankers after infection is established. Thus, the Duarte plum, highly susceptible on a basis of tree mortality, was consistently less favourable to canker progress than President, which suffered less during two years' observations. Duarte is highly susceptible to infection through buds.

Periderm formation and callus development were found to depend upon the growth activity of the tree. Plum varieties beginning growth early, such as Beauty, Kelsey, Santa Rosa, and Duarte, developed periderm around diseased areas and callus at the surface of wounds earlier than those beginning growth late, such as President, Grand Duke, and Tragedy. Cankers in early-blooming plum varieties stop activity earlier in spring than cankers in late blooming varieties. The data obtained indicated a certain relation between periderm development and cessation of canker extension, but did not prove that the periderm prevented canker activity.

Hesse (C. O.). **Variation in resistance to brown rot in Apricot varieties and seedling progenies.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 266–268, 1 fig., 1939.

Observations in the spring of 1935 and in that of 1938, when the weather conditions prevailing in central California were exceptionally favourable to the development of apricot brown rot [*Sclerotinia laxa* and *S. fructicola*: *R.A.M.*, xviii, p. 533], indicated that the varieties Royal, St. Ambroise, Blenheim, Derby Royal, Newcastle, and Oullins Early are very susceptible, Tilton, Wenatchee Moorpark, Hemskirke, and Hersey Moorpark resistant, and Moorpark and Peach most resistant of all those grown locally. This ranking agrees with general observations made in California in other years. Data obtained from seedling apricot progenies suggests that St. Ambroise, Moorpark, and Tilton transmit resistance to brown rot to their progenies in the order named, whereas Royal transmits susceptibility. Hybrids of the susceptible St. Am-

broise were invariably among the most resistant, regardless of the other parent.

Robertson (C. W.) & Cation (D.). **Basicop as a Cherry spray in 1938.** —*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 4, pp. 291–295, 1 fig., 1939.

In further comparative spraying tests against cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xvii, p. 694; xviii, p. 261] in Michigan, four applications of liquid lime-sulphur (2½–100) again failed to give adequate control, while four of Bordeaux mixture (6–8–100) tended to dwarf the fruit and cause injury to the foliage. Cupro-K gave good control, but with severe leaf injury. Basicop used with lime (3–8–100 or 3–6–100) gave satisfactory control with little perceptible injury, but without lime or zinc sulphate-lime it consistently damaged the foliage. In preliminary tests, four applications of basicop-zinc sulphate-lime (2–1–1½–100) gave adequate control with no injury.

Wean (R. E.). **Leaf-spot of Black Cherry.**—*Proc. Ind. Acad. Sci., 1938*, xlviii, pp. 48–49, 1 fig., 1939:

In inoculation experiments at Purdue University, Indiana, with the conidial (*Cylindrosporium*) stage of leaf spot (*Coccomyces*) [*hiemalis*] on seedling black cherry (*Prunus serotina*) leaves [see preceding abstract], there were only 18·2 lesions on the upper surface after 15 days' incubation compared with 85·3 on the under, showing that particular care should be taken to secure good coverage of the lower sides with a fine spray. Good (but not complete) control of the disease was given by seven applications of a spray composed of 2 lb. each of copper phosphate and bentonite, 4 lb. hydrated lime, and 50 gals. water, or 2–3–50 Bordeaux mixture.

Gerhardt (F.) & Ryall (A. L.). **The storage of Sweet Cherries as influenced by carbon dioxide and volatile fungicides.**—*Tech. Bull. U.S. Dep. Agric.* 631, 20 pp., 1939.

Data are presented on the storage of sweet cherries in various concentrations of carbon dioxide [*R.A.M.*, xvi, p. 43] and in packing materials impregnated with certain volatile chemicals in a series of experiments conducted at Yakima, Washington, from 1935 to 1937.

The evaluation of gas tolerances at different temperatures for varying periods showed that Bing and Lambert cherries can be held in carbon dioxide without impairment of flavour for 12 days in 40 per cent. at 60° F., 10 in 75 at 45° (Bing only), 20 in 40 at 45°, 17 in 25 at 45° (also the more sensitive Napoleon or Royal Ann), and 31 in 10 at 32°. Fungal decay (*Rhizopus* [*nigricans*], *Monilia*, and *Penicillium*) [loc. cit.] was controlled during 17 to 20 days' storage at 45° in 25 per cent. carbon dioxide. Since a strength of 40 per cent. caused no injury to the fruit at this temperature, the gas can evidently be used with safety over a fairly wide range of concentrations. The addition of 25 per cent. carbon dioxide to the storage air at 45° inhibited decay more effectively than did a 30 per cent. drop in temperature (from 45° to 32°). For firmness, brightness, freshness, and freedom from fungal rots, gas storage at 45° (25 per cent.) is preferable to air storage at 32°. At 40 , 15 per cent.

carbon dioxide sufficed to retard decay to a greater extent than air storage at 32°. Surface pitting was reduced by the storage of the fruit in atmospheres containing 15 and 25 per cent. carbon dioxide.

The fungicidal value of sodium bisulphite in the control of cherry rots was negligible, and the compound further impaired the taste and colour of the fruit. Similar objections apply to methyl bromide, dichloramine-T, and organic iodine compounds. Elemental iodine effectively suppressed fungal growth, but only when used at concentrations liable to produce lenticel burning and superficial discoloration of the fruit.

Roos (K.). **Das Kirschbaumsterben im Baselland. 2. Mitteilung : Die Erscheinungsformen der Krankheit.** [The dying of Cherry trees in the Basle district. Note 2: the symptoms of the disease.].—*Landw. Jb. Schweiz*, liii, 3, pp. 233–258, 30 figs., 1939. [French summary.]

In anatomical studies on the dying-off of cherries reported from the Basle district of Switzerland [*R.A.M.*, xviii, p. 122] it was found that the leaves of affected trees are thicker than those of healthy ones; the mesophyll varies markedly in thickness and frequently cavities are formed between it and the lower epidermis. The vascular bundles of the diseased leaves are smaller than normal and in the cross-sections of the petioles appear entirely disorganized, particularly in the phloem. The width of the annual rings is less, and after the disease has persisted for several years only a few rows of spring wood and none of summer or autumn are added each year, the rings becoming quite indistinct. An abnormal gum production occurs in trees which have been suffering from the disease for many years, the vessels of the branches, stems, and roots being blocked by gum plugs, so that the water-supply is cut off and the branches die primarily from physiological drought. In a partially diseased cherry tree most of the blocked vessels occurred on the diseased side, chiefly in the tap-root and the stem base; the smallest lateral roots were dead, their phloem was quite brown, and the xylem was in process of gum formation and decomposition. Young, newly diseased trees had no blocked vessels, but the medullary rays of the stems and tap-roots showed single cells or rows of cells completely filled with gum. It is concluded from these observations that the abnormal gum production is not the cause of the disease but a secondary symptom.

Clark (J. H.). **Prevalence of certain diseases affecting the foliage in some Strawberry progenies.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 455–460, 1939.

Observations made in 1937 at the New Jersey Experiment Station on 19 strawberry progenies each including 50 or more seedlings showed that the percentages of seedlings entirely free from scorch (*Diplocarpon earliana*) [*R.A.M.*, xviii, p. 402] ranged from 28·8 per cent. in the cross New Jersey 303× New Jersey 327 to 2·1 per cent. in the cross New Jersey 430× New Jersey 141. New Jersey 327 (Teddy Roosevelt× Pearl), to a greater extent than any of the other 14 varieties used as parents, was associated with a comparatively high percentage of healthy seedlings. There was generally a low percentage of unaffected seedlings when Aberdeen, Chesapeake, or 10A (a selection of *Fragaria chiloensis*) appeared in the ancestry, though when varieties with Aberdeen in the

ancestry were crossed with New Jersey 327 there was a comparatively high percentage of healthy seedlings. The only variety in the ancestry of these progenies which was rather consistently associated with scorch resistance was Teddy Roosevelt. The data also indicated that Fairfax, Pearl, and Wyona are intermediate in their ability to transmit resistance, which does not appear to be governed by a single gene, but for which some interaction of factors is probably responsible.

Records from 2,860 seedlings in 1937 failed to indicate that any one of the 19 varieties known to appear in the ancestry of the parents was more closely associated with resistance to mildew (*Sphaerotheca humuli*) [loc. cit.] than any other. The seedlings, however, of five different crosses in which New Jersey 520 appeared as a parent all showed under 5 per cent. infection; in addition, the following, it is thought, may prove of value as parents in breeding for resistance: New Jersey 444 and 445, both second-generation selfed seedlings of Aberdeen; New Jersey 388 and 390, both crosses between Fairfax and 10A; New Jersey 303; and perhaps Catskill. The data indicated that resistance to *S. humuli* is probably due to more than one gene.

Records since 1930 of seedlings showing June yellows [ibid., xviii, p. 191], now generally accepted as being non-infective and genetic in origin, indicated *inter alia* that the yellow character is inheritable, and not due to a single gene.

Castellani (E.). **Su un marciume dell' Eneste.** [On a rot of the Abyssinian Banana.]—*Agricoltura colon.*, xxxiii, 5, pp. 297–300, 2 figs., 1939.

Musa ensete plants growing in the vicinity of Garo and Sidamo (Italian East Africa) were observed by the author to show a disease [the symptoms of which are described] apparently closely resembling 'moko' disease (*Bacterium solanacearum*) [*R.A.M.*, xviii, p. 328], which proved rapidly fatal to young plants under 2 or 3 m. high. Infected material showed the presence of a bacterium which in culture resembled *Bact. solanacearum*, though further tests are required for its identification. The paper concludes with brief suggestions for control.

Parris (G. K.). **A new disease of Papaya in Hawaii.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 263–268, 3 figs., 1939.

A new disease of papaws, causing losses ranging from 6 to over 30 per cent., noted in July, 1937, on the island of Oahu, Hawaii [see above, p. 657], produces marked stunting of the plants, with yellow, crinkled leaves bent downwards and inwards. Little necrosis is present, except at the edges of very young leaves and in the interveinal regions of older ones. As a rule, only the upper two-thirds of affected trees show any symptoms. The affected leaves abscise rapidly, and four to six weeks after the first symptoms have appeared only a few badly distorted, dwarfed leaves are left, clustered together at the top. The leaves developed before any symptoms became apparent persist as a fringe round the base of the plant.

The petioles of the diseased leaves are bent downwards at the point of attachment, and the yellowed leaves bear small, necrotic lesions with yellow margins which range from pin-points to about $\frac{1}{8}$ in. in diameter. The yellow haloes may be small or quite extensive.

Linear, dark green, raised, hydrotic-like streaks, $\frac{1}{8}$ to 1 in. long by $\frac{1}{32}$ to $\frac{3}{8}$ in. wide, may be present on any part of the main stem and on the petioles of the affected leaves. Streaking precedes the development of the yellow discoloration. The fruits are small and 'bleed' profusely.

No organism appeared to be associated with the condition, which is thought to be of virus origin. Juice inoculations from diseased to healthy papaw plants by the carborundum method gave over 75 per cent. successful transmissions, the symptoms appearing within 16 to 21 days.

STEVENS (H. E.). **Avocado sun-blotch in Florida.**—*Phytopathology*, xxix, 6, pp. 537–541, 1 fig., 1939.

The Taylor and Nabal avocado varieties, top-worked on Taft trees grafted on West Indian stocks, have shown definite symptoms of sun blotch [*R.A.M.*, xiv, p. 707] in Florida, where the disease was not hitherto known to occur. The Nabal scions were obtained from apparently healthy trees in California, where sun blotch is prevalent, and so far Taft is the only stock on which the grafts developed symptoms. An infected scion may admittedly transmit sun blotch to the stock on which it is grafted, and the latter, if used later for re-budding or re-grafting, may in turn convey the disease to the new top. In the present instance, however, no sun blotch was observed on the Tafts before top-working, and the origin of the outbreak is difficult to explain, unless infection was carried in the original Taft scions in a latent form.

BERGMAN (H. F.). **Observations on powdery mildew on cultivated Blueberries in Massachusetts in 1938.**—*Phytopathology*, xxix, 6, pp. 545–546, 1939.

Observations in 1938 on the varietal reaction of blueberries[*Vaccinium* spp.] in Massachusetts to powdery mildew (*Microsphaera*) [*alni* var. *vaccinii*: *R.A.M.*, xiii, p. 496] indicate that Pioneer is the most susceptible variety followed by Cabot and Wareham, and Rancocas, Stanley, and especially Harding and Katherine are resistant, while an intermediate position is occupied by Concord, Jersey, and Rubel, the last-named varying greatly in different plantings. In a progeny test in connexion with a scheme for developing resistance by selection, some of the 200 to 300 seedlings of a cross between Wareham and Pioneer were almost free from mildew, others were extensively infected, and between these extremes all gradations were observed. It is thus apparently possible to secure a high degree of resistance even among the offspring of highly to moderately susceptible blueberry varieties.

FRYER (J. C. F.). **Plant protection.**—*ex* Agriculture in the Twentieth Century, pp. 291–307, Oxford, Clarendon Press, 1939.

An outline of the history of plant protection in England is given, and the present organization of the phytopathological service described. Achievements in the control of major pests and diseases since 1913 are also briefly discussed.

Shutak (V. G.) & Christopher (E. P.). **The influence of Bordeaux spray on the growth and yield of Tomato plants.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 747–749, 1939.

In a test carried out in Rhode Island, Marglobe tomato plants were sprayed between 9 and 10 a.m. standard time at fortnightly intervals from 22nd June, approximately 1 l. of spray being used per plant, with Bordeaux mixture (4–4–50, 4–12–50, and 12–4–50) [*R.A.M.*, xvi, p. 714; xvii, p. 712], of which the last gave a positive test for copper with potassium ferrocyanide.

The results obtained [which are tabulated] showed that the plants sprayed with the 12–4–50, 4–4–50, and 4–12–50 Bordeaux mixture and the unsprayed controls reached, respectively, a final height of 53·7, 52·2, 44·1, and 50·1 in., showed on 30th September 53, 63, 78, and 82 per cent. dead leaves, and gave total yields of 17·7, 16·92, 12·51, and 15·51 tons per acre. The 4–12–50 mixture caused severe desiccation of the young leaves and terminals, while the 12–4–50 mixture gave very effective disease control and produced no visible injury.

The data obtained indicated that Bordeaux mixture retards ripening, but may control disease well enough to increase total yield in some seasons. High-lime Bordeaux mixture should be avoided, but high-copper mixture may be safely used.

Horsfall (J. G.), Hervey (G. E. R.), and Suit (R. F.). **Dwarfing of Cucurbits sprayed with Bordeaux mixture.**—*J. agric. Res.*, lviii, 12, pp. 911–927, 2 figs., 5 graphs, 1939.

In an investigation of the factors responsible for the injury caused by Bordeaux mixture to cucurbits [*R.A.M.*, xv, p. 197], the authors found in experiments with Chicago Pickling cucumbers and Honey Rock muskmelons that, of the three elements composing Bordeaux mixture, copper does not seem to be the primary cause of dwarfing and leaf deformation, unless it is rendered soluble by low hydrogen-ion concentration, whereas lime definitely causes both types of injury and water further aggravates the deleterious effect. An increase in spray load resulted in increased injury. The hydrogen-ion concentration of the spray appeared to be of chief importance: the optimum growth of plants was obtained with a spray mixture approximating $P_H 7$, while more acid or more alkaline sprays reduced growth irrespective of whether copper was present or not. It is suggested that the lime may also possibly cause dwarfing as calcium is known to harden the tissues, thus preventing cell enlargement. It is tentatively concluded from the data obtained in this study that the dwarfing of cucurbits may result from the effect of Bordeaux mixture on transpiration leading to a physiological drought [cf. ibid., xviii, p. 465], from the action of calcium in hardening the young cells, and from reduced photosynthesis owing to the stomata being clogged by the spray.

Cunningham (G. H.). **Certification of therapeutants.**—*N.Z. J. Sci. Tech.*, xxa, 5, pp. 326–328, 1939.

A list (cancelling the three previously issued) is given of 31 plant protectives tested, approved, and passed for general trading by the Plant

Research Bureau, Department of Scientific and Industrial Research, New Zealand.

VERONA (O.). **Studio sulle cause microbiche che danneggiano la carta e i libri.** [A study on the microbic agents damaging paper and books.]—*Cellulosa*, ii, 2, pp. 94–100; 3, pp. 139–142; 5, pp. 253–256; 6, pp. 308–314, 1938; iii, 1, pp. 38–45; 2, pp. 94–107, 2 col. pl., 31 figs., 2 graphs, 1939. [English summary.]

This is a comprehensive, thoroughly documented study of the micro-organisms concerned in the injury of paper and books in Italy [cf. *R.A.M.*, xviii, p. 362]. The fungi isolated from old books and newly manufactured paper were cultured on malt agar, yeast infusion agar with peptone and glucose, bean agar, carrot slices, and Raulin's liquid, and tested for their carbon and nitrogen requirements and hydrogen-ion relationships by standard methods. They included *Chaetomium elatum*, *C. kunzeanum* [*C. globosum*: *R.A.M.*, xii, p. 779; xv, p. 741; xvi, pp. 147, 773, 838; xvii, p. 791], *Phoma chartae* n.sp., *Cephalosporium* (*Allantospora*) *ciferrii* n.sp., *Trichoderma lignorum*, *Gliocladium roseum* [ibid., xiv, p. 392], *Coniosporium perottianum* n.sp., *Stachybotrys atra* [ibid., ix, p. 455] (with which *S. lobulata* [ibid., xiv, p. 584; xv, p. 741; xvi, p. 147] and *S. alternans* [ibid., xv, p. 673; xviii, p. 362] are considered to be identical), and *S. atra* var. *brevicaule* n.var. Latin diagnoses are given of the new species and variety, together with an emended diagnosis of *S. atra*.

P. chartae is characterized by a hyaline to subolivaceous mycelium, 2·4 to 2·8 μ in diameter; black pycnidia measuring 230 to 360 μ in diameter in culture and 380 to 600 μ on paper, producing hyaline pycnospores, 5·1 to 6·4 by 2·8 to 3·2 μ; and also by hyaline, simple conidiophores, 6·4 to 8·2 by 2·4 to 2·8 μ, and hyaline, elliptical or subovoid conidia, 5·1 to 6·4 by 2·4 to 2·8 μ. Its optimum hydrogen-ion concentration is P_H4; glucose was the best source of carbon and asparagin and potassium nitrate the most easily assimilable forms of nitrogen.

Cephalosporium ciferrii produces a hyaline, branched, septate mycelium, 2·8 to 3·2 μ in diameter, mostly simple, subsessile conidiophores, 15 to 25 μ long, bearing in heads, 12 to 20 μ in diameter, 20 to 40 cylindrical or subreniform, occasionally elliptical, ovoid, hyaline, continuous or rarely uni- or biseptate conidia, 4·8 to 9·6 by 2·5 to 3·2 μ. Peptone served as the best source of nitrogen, while glucose, galactose, and saccharose were the most fully utilized of the carbohydrates. Growth was favoured by a neutral to slightly alkaline reaction.

The aerial mycelium of *Coniosporium perottianum* in culture is effuse, woolly, white, septate, 2·2 to 2·8 μ in diameter, and the submerged fuliginous-brown, septate, branched, 3·2 μ. The few conidiophores produced are hyaline and measure only 6 to 8 μ in length, and the globose or subpiriform, hyaline, later olivaceous and finally blackening, smooth conidia, arising directly from the mycelium or subsessile, are 9·6 to 12·8 μ in diameter. The best sources of nitrogen and carbon are asparagin and saccharose, respectively, and the optimum reaction P_H6.

S. atra var. *brevicaule* differs from the type in its shorter conidiophores, 9·6 to 32 μ, average 19 to 22 μ.

Inoculation experiments on paper with *Chaetomium elatum*, *C.*

globosum, *C. botrichodes*, *S. atra* and its var. *brevicaule*, *Fusarium* sp., *Alternaria* sp., *P. chartae*, and *T. lignorum* resulted in the development of typical staining.

Control measures should be based on a rational treatment of the paper during manufacturing processes, incorporating a reliable disinfectant with the gum, using filtered water for washing and providing well-aerated premises, and the periodical fumigation of libraries with formaldehyde.

Handbuch der Pflanzenkrankheiten. Sechster Band. Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten. [Handbook of plant diseases. Volume VI. Plant protection. Prevention and control of plant diseases.]—Lieferung 3, pp. 577–647, 50 figs., 20 diags., Berlin, P. Parey, 1939. RM. 17·80.

The present instalment of the sixth revised edition of Sorauer's 'Handbook of Plant Diseases', issued under the general supervision of Dr. O. Appel [*R.A.M.*, xviii, p. 43], comprises the conclusion of the section on physical and chemical methods of testing plant protectives by G. Hilgendorff and W. Fischer, and comprehensive, fully documented contributions dealing with the biological control of plant diseases and pests (H. Sachtleben) and technical methods of plant protection, including liquid steeping apparatus (E. Riehm), dusting equipment (A. Winkelmann), and spraying machinery (H. Zillig—incomplete).

Carter (W.). **Injuries to plants caused by insect toxins.**—*Bot. Rev.*, v, 5, pp. 273–326, 1939.

This is a very comprehensive review of the information available to date on the symptoms of phytotoxaemias of insect origin on a large number of plants. A bibliography of 257 titles is appended.

Gratia (A.) & Manil (P.). **Recherches sur les virus des plantes. (Premier mémoire).** [Studies on plant viruses. (First memoir).]—*Arch. ges. Virusforsch.*, i, 1, pp. 21–45, 1 diag., 1939.

This is a tabulated survey, amplified by numerous references to the current literature, of the authors' experiments on plant viruses, extending over a period of five years, at the Liège Bacteriological Institute and Gembloux Agricultural Station, Belgium.

Salaman (R. N.). **Outlines of the history of plant virus research.**—*ex* Agriculture in the Twentieth Century, pp. 261–289, Oxford, Clarendon Press, 1939.

The author reviews the progress of research in plant virus diseases throughout the world and briefly sums up the present knowledge on various aspects of the subject.

Вирусные болезни растений. Сборник 2. Под ред. М. С. Дунина. [Virus diseases of plants. Collection II. Edited by M. S. Dounin.] —240 pp., 58 figs., 11 graphs, 9 diags., Moscow, Изд. Всесоюзн. Инст. Защ. Рас. [Publ. pan-Soviet Inst. Pl. Prot.], 1938. [Received July, 1939.]

Among the 14 papers and nine summaries included in this book the following may be noted.

L. Kara-Mourza. Physiological changes in virus-affected cotton (pp. 56–72). In a study on cotton leaf curl in Azerbaidjan [*R.A.M.*, xvii, p. 392] the dry weight of the infected plant averaged only 59 per cent. of that of the healthy plant, the number of bolls was reduced to 58·8 per cent., and the dry weight of the roots to 36·6 per cent. Diseased leaves are thicker than healthy ones (418 μ and 233 μ, respectively), and often form a second palisade layer on the upper side but sometimes also on the lower side; leaf cells are very enlarged, and those of the veins and petioles contain large numbers of starch granules which are absent from healthy leaves. Transpiration is generally lower in diseased plants than in healthy ones, except in the evening, when it is often higher. The nitrogen content of the sap is higher than in healthy leaves.

R. P. Nikolaeff & Mme S. M. Kondratieva. A comparative biochemical description of healthy potatoes and potatoes affected with virus diseases (pp. 73–82). The results of this study show that the percentage water content of tubers affected by rugose mosaic, crinkle, aucuba mosaic, or leaf roll is from 3 to 10 per cent. higher than that of healthy tubers or tubers from streaked plants. The amylase and peroxydase activity was generally higher in healthy than in diseased tubers: for instance, in the variety Wohltmann 7805 the peroxidase activity expressed in seconds was 2·4 in healthy tubers, 1·0 in mottle, 2·1 in leaf roll, and 1·1 in crinkle tubers. The catalase activity was generally lower in diseased than in healthy tubers.

N. A. Ryachovsky. Leaf curling of tomatoes in the districts of Kursk and Voronezh (pp. 83–100). Of the 42 tomato-growing farms in the Kursk and Voronezh districts of the U.S.S.R. only two were found free from leaf curling [ibid., x, p. 493; cf. xv, p. 556] during 1933–4, half of the others being severely affected by the disease. A three-year study on the harmfulness of this disease, the origin of which as yet remains unknown, showed that it reduces the length of the stem by 17·9 per cent., its thickness by 9 per cent., the number of pinnae by 10·4 per cent., and the size of the leaf surface by 51 per cent., but has no effect on the number of leaves. The average loss in yield for three years was 30, 45, and 70 per cent. for mildly, moderately, and severely affected plants, respectively. The weight of individual fruits was reduced by from 5·9 to 22·9 per cent. on diseased plants during the wet year 1933, but no such reduction occurred during the following dry year. Infection was found to be carried by the seed, the presence of even the slightest infection in one year causing 100 per cent. infection in the following season. It is considered premature at this stage of the investigations to draw conclusions as to the nature of the disease.

Mme E. A. Asnitzkaya. Streak of tomatoes (pp. 101–109). Tomato streak [ibid., xvi, p. 210] is stated to be a new disease for the U.S.S.R. In 1935 the percentage of infection recorded in various parts of the Union varied from 20 to 100 per cent. in the glasshouses and up to 10 per cent. in the field. The virus nature of the disease was proved in inoculations with sap filtered through a Chamberland candle. A serological analysis (by the drop method) of plants affected with streak showed the presence of the tobacco mosaic virus and potato virus Y [? X]. Successful inoculations with suspensions of ground seeds from diseased plants indicate that the virus may be seed-borne. In two pot experiments it is

stated that 80 and 50 per cent., respectively, of the plants grown in soil moistened with the expressed juice of infected plants developed the disease. Pruned tomatoes showed 4·7 per cent. infection as compared with 1·3 per cent. in the unpruned controls. The disease was more prevalent in cold frames (particularly for late sown tomatoes) and in glasshouses in winter than in hot-beds, and in glasshouses with overhead watering than in those with underground irrigation. The percentage of infected plants was considerably reduced by the addition of nitrogen and potassium to the soil before transplanting. Under glasshouse conditions Sparks' Earliana and Boudennovka were the most susceptible among the ten varieties tested.

M. N. Medish. The spread of 'stolbur' of tomatoes in connexion with ecological conditions. Preliminary information (pp. 110–116). A disease of tomatoes observed in 1935 in the Krasnodar district is thought to be identical with 'stolbur' as described by Russian authors and with big bud reported from Australia [ibid., xviii, p. 631]. Field observations showed that the infection never exceeded 1 per cent. on low and moist sites, while it amounted to 20 per cent. in dry situations, and that the considerable amount of precipitation during September usually arrested the further development of the disease. It appears therefore that the development of 'stolbur' is related to the water economy of the plant.

I. K. Koratchevsky & Mme A. V. Semenkova. On the susceptibility of Solanaceae and Convolvulaceae to 'stolbur' (pp. 118–124). In work carried out during 1935–6 in the Crimea, 'stolbur' was artificially transmitted to tomato from eggplant, *Physalis peruviana*, chilli, and *Solanum nigrum*. Suspected hosts, showing anatomical and morphological characteristics similar to those of plants infected by 'stolbur', are *Convolvulus arvensis*, sweet potato, potato, and *Taraxacum megalorrhizon* var. *gumnanthum*.

J. Tzivenko. Virus diseases of *Physalis angulata* L. (pp. 125–132). Observations carried out at Kharkoff on Mexican tomato (*P. angulata*), which is stated to be a valuable crop for the northern districts of the U.S.S.R., being more hardy than ordinary tomatoes, revealed the presence of four types of virus disease. The first to appear was mosaic, which reduced the height of the plant from 70 to 80 cm. to 40 to 50 cm. 'Giantism' increased the height of the plant from 70 to 80 to 90 to 110 cm., the thickness of the stem (at the base) from 2 to 2·5 to 2·5 to 3 cm., the size of the leaf from 7·5 by 2 to 11·5 by 7 cm., and the number of flower buds. 'Stringiness', a severe form of tomato fern leaf [ibid., xvii, p. 78], drastically reduced the size of the leaves and lowered the height of the plant. Reductions in the yield caused by these diseases were from 104 fruits in the healthy plant to 50, 14, and 6, respectively. Leaf roll was observed only on a few plants. Plants affected with either of the virus diseases described had longer pistils and shorter stamens than healthy plants.

N. I. Feiginson. Virus diseases of fruit trees (pp. 139–180). Following brief descriptions of known virus diseases of fruit trees, the author states that so far mosaic has been tentatively identified in the U.S.S.R. on apples, pears, cherries, plums, peaches, and apricots.

Mme O. B. Nataljina. Virus diseases of cultivated berries (pp. 181–196). In the Moscow, Leningrad, and Gorky districts raspberries have

been found affected with diseases believed to be identical with curl [ibid., xvi, p. 194], dwarf [ibid., xviii, p. 377], leaf roll [loc. cit.], and yellows [loc. cit.]. In 1936 curl affected 5·1 per cent. of raspberries in the Moscow district, Usanka being the most susceptible variety, and yellows occurred on 55·6 per cent. of raspberries in the Moscow and 49·3 per cent. in the Gorky districts, being less serious in that of Leningrad. Moderate and severe yellows were found to reduce the yield by 42 and 38 per cent., respectively. Black currants were attacked by streak chlorosis, though the disease was not very widely spread and was less injurious than reversion [loc. cit.], which often occurred simultaneously. In 1936 reversion affected 40 per cent. of currants in the Gorky, 26·5 per cent. in the Moscow, and 0·2 per cent. in the Leningrad districts.

Lihnell (D.). **Untersuchungen über die Mykorrhizen und die Wurzelpilze von Juniperus communis.** [Studies on the mycorrhiza and root fungi of *Juniperus communis*.]—*Symb. bot. upsaliens.*, iii, 3, 141 pp., 3 pl., 18 figs., 1939.

The juniper (*Juniperus communis*) roots from about 50 localities of Sweden examined by the author from 1932 to 1938 at the Upsala Botanical Institute were uniformly covered with a mycelial network, dense in some samples and sparse in others, consisting largely of the brown, regularly septate hyphae of *Mycelium radicis atrovirens* [*R.A.M.*, xviii, p. 608].

Many of the organisms isolated in pure culture on 2·5 per cent. malt extract (agar or solution) and tested for mycorrhizal synthesis assumed an entirely passive attitude towards the juniper roots, which they failed to penetrate; among these were *Mortierella alpina*, *Mucor* spp., including *M. ramannianus*, and *Mycelium radicis juniperi* IV, VI, VII, and X. From these observations it may be inferred that the fungi in question also lead a purely epiphytic existence on the roots in nature. The remaining fungi under investigation acted in a more or less parasitic manner, though a number of them, e.g., *M. r. juniperi* III, V, VIII, and IX, were unable to traverse the hypodermal layers to which their hyphae were confined and their activity soon ceased. Vigorous parasites like *Rhizoctonia juniperi*, however, cannot be restrained by the hypodermal 'armour' from deeper penetration. For example, *R. juniperi* (characterized by a matted, white, later reddish mycelium, consisting of septate, profusely branched hyphae, 3 μ in diameter, frequently with a spiral upward rolling at the apex and sometimes forming cords) and *M. r. atrovirens* formed chlamydospore chains which eventually developed into sclerotia in the hypodermal region, whereas in the subhypodermal layers the fungi existed exclusively as thin-walled hyphae. The black hyphal coating formed by *M. r. juniperi* III (dark brown, hyaline-tipped, septate hyphae, 2·5 to 3·5 μ in diameter) round the roots was somewhat reminiscent of the 'mantles' of ectotrophic mycorrhiza, from which it differed, however, in its extreme irregularity. Roots inoculated with *M. r. juniperi* VIII reacted by the envelopment of the hyphal tips in dotted tubular sheaths with lignified walls, similar to those observed in cases of spontaneous infection and usually serving to prevent the further progress of the fungus. *M. r. atrovirens*, notwith-

standing its prevalence as a symbiont of juniper roots, appears to be only a weak parasite on healthy material.

Ectotrophic mycorrhiza of the *M. r. nigrostrigosum* type [ibid., xv, p. 308] were found on roots from only two of the 50 localities represented in the investigations, forming a 'mantle', 30 to 35 μ in thickness, composed of very thick-walled, brownish-black hyphae, 3·5 to 5 μ in diameter. In an as yet unpublished study the writer has demonstrated the probable identity of this organism with *Coenococcum graniforme*, described from Denmark by Ferdinandsen and Winge (*K. VetHøjsk. Aarsskr.*, 1925); not only are the mycelia in pure culture identical but anastomosis takes place freely between them. Inoculation experiments with *C. graniforme* on juniper did not, it is true, lead to the formation of the typical reticulate 'mantle' associated with *M. r. nigrostrigosum*, but the characteristic structures were produced on Scots pine (*Pinus sylvestris*) and birch (*Betula verrucosa*); thick 'mantles' were formed on willow (*Salix repens*), while on spruce (*Picea abies*) the transitional forms between complete mycorrhiza and simple, undifferentiated hyphal overgrowths resembled those developing on juniper. Apparently the natural tendency of *C. graniforme* (*M. r. nigrostrigosum*) to form mycorrhiza is easily checked, in the case of its less congenial hosts, by the relatively unfavourable conditions prevailing in artificial culture.

The endotrophic mycorrhiza of junipers conforms to the standard vesicular-arbuscular or Phycomycetoid type [ibid., xviii, p. 468], for which the author prefers Burgeff's (1938) term 'thamniscophagous'. Most of the primary roots of the trees in all the localities investigated were already at this early stage converted into endophytic mycorrhiza, the anatomical characters of which displayed a remarkable uniformity irrespective of their place of origin or of the constitution of the soil. The penetration of the fungus into the roots is effected, mostly in June and early July, through the transfusion cells of the hypodermis, assisted no doubt by the chemotropic stimulus of assimilable host secretions. The invading hypha generally forms a few simple loops in the transfusion cells and first subhypodermal layer, branching only commencing in the next layer, whence it extends both longitudinally and laterally until finally the whole primary cortex as far as the endodermis is involved, though the central cylinder is never attained and the meristematic tissues remain free from infection until the root tip becomes metacutinized at the end of the growing period. The average diameter of the normally non-septate hyphae, containing a variable number of nuclei, 1·5 to 2 μ in diameter, is 4 to 6 μ, but a thickness of 10 μ may be reached. The walls contain chitin and in all probability cellulose.

The spherical to oval vesicles begin to develop in the second and third cortical layers and measure on an average 60 by 30 μ, with walls up to 3 μ in thickness. The function of these organs is not quite clear, but in the writer's opinion they most likely act as receptacles for the accumulation of reserve foodstuffs for the winter months, the sporangial interpretation being regarded as untenable. On the other hand, the arbuscules, developing through the gradual attenuation of the hyphal branches from relatively coarse to extremely slender (0·5 to 0·8 μ) dimensions, would appear to undergo an eventual transformation into sporangioles,

5 to 10 or 15 μ in diameter. Gallaud's (*Rev. gén. Bot.*, xvii, 1905) view that the arbuscules are of the nature of haustoria is considered to be the most plausible. In this connexion the physiological relationships between the endophyte and its host are critically discussed at some length, and a survey is given of early and recent literature on this and cognate aspects of the mycorrhizal question.

Jameson (Dorothy H.) & Schmidt (Catherine M.). **Boron as a plant nutrient. [A bibliography of literature published and reviewed, July, 1938, to December, 1938, inclusive.] (With index.) Supplement I.**—40+vi pp., American Potash Institute, Inc., Washington, D.C., 1939. [Mimeographed.]

This supplement to the annotated bibliography of the literature of boron as a plant nutrient published by the American Potash Institute [*R.A.M.*, xviii, p. 199] contains 172 items.

Milad (Y.). **Physiological studies in lime-induced chlorosis.**—*Bull. Minist. Agric. Egypt* 211, 56 pp., 7 pl., 3 graphs, 1939.

Studies [which are described in detail] carried out by the author in California in 1925 to 1927 into lime-induced chlorosis of pear trees growing in calcareous soils containing 15 to 40 per cent. calcium carbonate showed that, as a rule, the leaves and stems contained less iron per unit dry weight than similar leaves and stems of normal pear trees on non-calcareous soils. The affected leaves contained a higher percentage of calcium and manganese than green ones from calcareous or non-calcareous soils, but twigs and two- to three-year-old stems did not show this difference. Chlorotic and green leaves of about the same age and taken from the same orchard varied considerably in percentage of iron present, based on dry weight; in many cases chlorotic leaves contained higher percentages of iron than some of the green foliage.

Analyses of tracheal sap showed that in every instance the sap from trees on calcareous soils had a higher P_H value than that from trees on non-calcareous soils. The chlorotic stems had the highest value (P_H7 to 7·2), normal green stems from non-calcareous soils the lowest value (P_H6 to 6·2), and green stems from the calcareous soils were intermediate. The alkalinity of the tracheal sap in the chlorotic trees did not appear to cause any precipitation of iron in the wood of the tree or in the veins of the leaves, but sometimes induced a high iron content in chlorotic leaves by decreasing the solubility of the incoming iron in the leaf cells.

The susceptibility of pears, apples, white lupins, and rice to chlorosis on calcareous soils was ascertained to be associated with slow production of carbon dioxide by the roots. The importance of carbon dioxide in increasing the solubility of iron in soils rich in lime was demonstrated by quantitative analysis. Chlorosis in white lupins [cf. *R.A.M.*, xviii, p. 530] growing in a suspension of calcareous soils was prevented experimentally by applications of carbon dioxide gas. It is suggested that the part played by carbon dioxide in increasing the availability of iron compounds in calcareous soils is due to its reducing the P_H value of the soil solution round the root hairs and rootlets, and to its action as a solvent for ferrous carbonate, which in the calcareous soil might be

formed from the reduction of ferric oxides in the presence of organic matter and excessive moisture.

PEYRONEL (B.). **Sulla durata della vitalità negli Zigomiceti.** [On the duration of vitality in the Zygomycetes.]—Reprinted from *Atti Accad. Torino*, lxxiv, 11 pp., 1939.

During more than ten years' study of the Zygomycetes the author had occasion from time to time to make transfers on to fresh medium of cultures of various ages of 87 species, varieties, races, and strains, in the course of which he found that when the transfers were made with due care all the fungi were living after 15 to 20 months in culture, while those possessing chlamydospores, giant cells, and zygospores were still alive after four to six years.

The maximum duration of vitality was shown by the genus *Absidia*, in which, out of 19 species, *A. capillata*, *A. coerulea*, and *A. glauca* [*R.A.M.*, xviii, p. 137] were still alive after 71 months in culture, while *A. hyalospora* and *A. lichtheimii* [ibid., xv, p. 314] were still alive after 64 and 59 months, respectively. Next in this respect came *Syncephalastrum*, in which the three species observed, viz. *S. cinereum* [ibid., xii, p. 149], a species from British Guiana, and a species from Florence, were still alive after 56, 57, and 56 months, respectively. In *Mucor*, out of 19 species observed only three were still alive after 50 months (*M. racemosus* and *M. circinelloides* [ibid., xviii, p. 137], each 57 months, *M. ambiguus*, 50).

The author attributes extreme longevity in culture to the presence of numerous chlamydospores, giant cells, or zygospores, which are rich in reserve materials and able to resist adverse environmental factors for long periods. This is illustrated by the case of *Rhizopus nigricans* and *R. arrhizus*, the former of which (showing very few zygospores) was found to retain its vitality in culture for only 18 months, while the latter (which produced abundant chlamydospores) was still alive after 58.

In the case of *A. glauca* and *A. coerulea*, both heterothallic [loc. cit.], the longest vitality was noted in culture containing mycelium of both sexes (71 months), while the cultures containing only plus mycelium were dead after 59. This would suggest that the most persistent organs are the zygospores, or that the chlamydospores, always present in the bisexual mycelium, do not develop in plus mycelium.

WYCKOFF (R. W. G.). **The ultracentrifugal analysis of the latent mosaic virus protein.**—*J. biol. Chem.*, cxxviii, 3, pp. 729–733, 1 diag., 1939.

The sedimentation diagram of a typical preparation of the latent mosaic of potato [potato virus X] obtained at the Rockefeller Institute for Medical Research, Princeton, New York, by subjecting the clarified juice of infected Turkish Tobacco plants to four successive ultracentrifugations at 30,000 r.p.m. presented the following features. The principal boundary is sharp, moving at a rate corresponding to the constant $S_{20}=113\times10^{-13}$ cm. sec.$^{-1}$ dynes^{-1}. A faint, sharp, second boundary with S_{20}=about 130×10^{-13} can also be perceived; the component responsible for this is sometimes absent, irrespective of whether the

sample has been purified by ultracentrifugation or salting-out. A single precipitation in the cold with either 30 per cent. ammonium sulphate or potassium citrate, followed by two ultracentrifugal sedimentations, gave a sharp-boundaried product, while a protein with a fairly sharp boundary was furnished by precipitation with hydrochloric acid at P_H4. Alcohol precipitation at P_H5 altered the protein so completely that no measurable sedimenting boundary was given. The virus protein molecule was found to bę stable within the general limits defining its toxicity (P_H 5·7 to 10·1), on the alkaline side of which an immediate and complete breakdown occurs, while in acid solutions proximity to the isoelectric point introduces a complex situation producing abrupt alternations in the boundaries between sharpness and diffuseness.

PILL (R.). **Uwagi dotyczace wykresu pojawów raka Ziemniaczànego w Woj. Sląskim od roku 1924 do 1937.** [Notes on the incidence of the Potato wart disease in the province of Silesia from the year 1924 to 1937.]—*Roczn. Ochr. Rośl.*, vi, 2, pp. 28–30, 1 graph, 1939. [German summary on pp. 39–40.]

The campaign against wart disease of potato [*Synchytrium endobioticum*: *R.A.M.*, xvi, p. 832] has been in progress in the Polish province of Silesia for the last ten years. In 1924 the disease covered 15 hect., in 1929 the maximum infection was reached when 343 hect. (in 1,529 farms) were infested, but by 1937 the area infected had fallen to 8·9 hect. (in 157 farms), owing to the planting of resistant varieties.

Bermuda Byelaws made by the Bermuda Board of Agriculture on 7th March, 1939, under the provisions of The Boards Act, 1929. Control of plant diseases and pests.—4 pp., 1939.

By changes in legislation made by the Bermuda Board of Agriculture on 7th March, 1939 [cf. *R.A.M.*, xvi, p. 143], cut flowers and fresh vegetables from the United States, formerly imported into Bermuda without restriction, are now subject to inspection on arrival between 1st June and 30th September. The importation of citrus fruits from the West Indies is no longer forbidden.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xiii, 5, p. 113, 1939.

NEW ZEALAND. The Orchard and Garden Diseases Act Extension Order of 18th January, 1939, proclaims the yellow dwarf disease of onions (*Allium* virus 1) [*R.A.M.*, xvii, p. 576] to be a disease within the meaning of the Orchard and Garden Diseases Act, 1928.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, xi, 2, pp. 63–64, 1939.

DENMARK. Under a decree of the Ministry of Agriculture dated 21st February, 1939, plants and parts thereof imported into Denmark from other countries must be accompanied by a properly authenticated certificate vouching for their origin in an area free from potato wart (*Synchytrium endobioticum*) and at least 5 km. distant from any place in which the disease has been observed during the past ten years [*R.A.M.*, xiv, p. 544].